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**HEAD-UP DISPLAY SYMBOLOGY**

**William P. Orrick, Jr., et al**

**Naval Air Development Center  
Warminster, Pennsylvania**

**31 December 1975**

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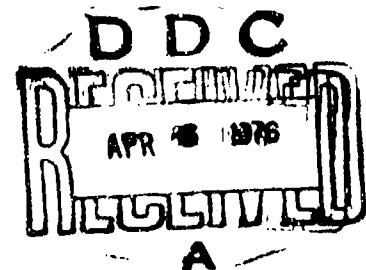


## HEAD-UP DISPLAY SYMBOLOGY

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)  This report consists of a table and accompanying illustrations which describe aircraft and weapons system functions displayed on the head-up displays in the A-7E, F-5, F-14, F-15, F-111A, CL-84, and AV-8A aircraft. Corresponding display formats as given in MIL-D-81641(AS) and MIL-STD-884B are included for comparison.		

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## INTRODUCTION

The head-up display (HUD) was developed to facilitate the transition between instrument and visual flight. The use of a HUD is becoming increasingly common. In spite of the existence of a Military Specification and a Military Standard which are written to promote consistency and to minimize occurrence of incompatible methods of presenting information, inconsistencies do exist. The following tables were prepared in order to facilitate comparison between existing head-up display formats, so that in the selection of symbols for future head-up displays inconsistencies will be minimized.

The tables included in this report contain data on displays found in the A-7E, F-5, F-14, F-15, F-111A, CL-84, and AV-8A aircraft. Data from the Military Specification pertaining to head-up displays, MIL-D-81641(AS), and the relevant Military Standard, MIL-STD-884B are included. The information in the tables was taken from the references listed. Where available, the NATOPS Manual (U.S. Navy) or Technical Orders (USAF) were considered the primary source. Information from secondary sources was included in the tables where it indicated additional functions or alternative ways of displaying the same functions.

## DESCRIPTION OF THE TABLES

Descriptive parameters are listed at the left edge of the tables. Functions are listed across the top edge. Functions are presented alphabetically and are consecutively numbered. Where there is more than one means of displaying a function for a given aircraft, additional columns are used. The function name is the same, and the same number is used with the notation "(cont)" to indicate continuation of the description. Explanation of the parameters, as necessary, is given below. Blanks in the body of the tables indicate that the parameter is not relevant or the required information was not available.

Function - In general, displays present standard aircraft or weapons information and the function names reflect this. There are two types of exceptions. One is where a function is peculiar to an aircraft; e.g., wing sweep in the F-14. The other exception concerns functions without qualifying adjectives where there should be a qualifier. An example is the use of the term "air-speed" without the accompanying "indicated," "true" or "calibrated." In such cases, a separate heading without the qualifier was included in the tables.

Figure No. - Refers to the figure which shows the display elements as described in the tables. In order to limit the number of figures, references are sometimes made to a figure showing a display similar to but not identical in format to the display described. For example, the number of scale graduations or intervals may be different, but the relationships among scale marks, numerals, pointers and labels are the same. It is possible to determine from the table entries and the figure how the display looks. Numerals in circles on the figures refer to the function number in the tables. Arrows from these encircled numerals point to display elements which are used for the function

whose number is given. Sometimes a figure number is given in a table entry for a function and the number of that function does not appear on the figure. This is either because the figure portrays only that function, the figure is self-explanatory or the relationship is completely explained in the notes for that function. In some cases, one of the above conditions holds yet there is a numeral on the figure. This is due to the conservative nature of the authors' approach.

**Form of Display** - The components of a functional display, as shown in the corresponding figure, were classified as scales (vertical, horizontal, or circular), ladders, digits, letters, alphanumerics, or symbology.

**Display Label** - Any letter(s) used to label the display are indicated. In the corresponding figure, a single letter has been drawn to indicate the position of a single letter label; two letters have been drawn to show the position of a double letter label. In each case, the letter(s) in the actual label may differ from those used in the figure.

**Range of Variable** - The range of parameter values which may be displayed is given.

**Range Displayed** - The range of parameter values which is displayed at a given time is indicated.

**Direction of Increase** - The direction of increasing parameter values is given in relationship to the appropriate scalar display. For a vertical scale, parameter values increase as one reads up the scale, down the scale, or both; for a horizontal scale, values increase as one reads to the left, to the right, or both. For a circular scale, values increase in a clockwise or a counter-clockwise direction.

**Fixed Scale** - "Yes" indicates the scale remains stationary; "no," the scale acts as a moving tape.

**Scale Values Marked** - "Yes" indicates scale graduations are labeled with numerals to indicate parameter values.

**Scale Graduations** - The change in parameter value for the smallest graduation on a scale is given.

**Moving Reference** - "Yes" indicates a reference mark changes its position on the screen in some manner.

**Modes** - With certain exceptions, modes are listed as named in reference sources (see mode list). In cases where the table entry does not correspond exactly to the mode list, the table entry will encompass more than one mode and will contain the word common to these modes. The only further exception is the use of the word "attack" to include all modes in the A-7II where a weapon is used.

**Notes** - When a function description has been obtained from a secondary reference source (reference 4 or reference 6) this is indicated by inclusion of the source number in the "notes" section.



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F-5 . . . . .	5	4
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CL-84 . . . . .	7	1
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		1
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AV-8A . . . . .	181	19
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NUMBER FUNCTION	1			2			3			4			5		
	DISPLAY LATERAL ACCELERATION			DISPLAY LATERAL ACCELERATION			DISPLAY VERTICAL ACCELERATION			DISPLAY VERTICAL ACCELERATION			DISPLAY ACCELE- RATION LIMIT		
AIRCRAFT	CL-84			FV-8A			A-7			F-14			F-5		
ENGINE NO.	1			50			2			3			4		
FORM OF DISPLAY	horizontal scale			horizontal scale			vertical scale			vertical scale			digital		
LOCATION ON HUD	upper center			below center			right edge			left edge			bottom center		
DISPLAY LABEL	none			none			none			G			none		
RANGE OF VARIABLE				±.09 G			+2 to +6 G			0 to +8 G					
NAME DISPLAYED				±.06 G			+2 to +6 G			0 to +8 G					
DIRECTION OF INCREASE	L & R			L & R			up			up					
FIXED SCALE?	yes			yes			yes			yes					
SCALE VALUES MARKED?	no			no			no			no					
SCALE GRADUATIONS				.06 G			1 G			2 G					
MOVING REFERENCE?	yes			yes			yes			yes					
TYPE OF REFERENCE	ball			ball			triangular pointer			letter G					
HOUSING IN WHICH FUNCTION IS AVAILABLE	approach; transi- tion			V/STOL			en route naviga- tion; terrain fol- lowing; attack (all)			all exc. landing			missile		
DISPLAY CHANGES WITH HUD CHANGES	none			none			none			none			none		
NOTES										ref. 4					

NUMBER FUNCTION	6 COMMAND AIRSPEED	7 COMMAND AIRSPEED	8 COMMAND AIRSPEED	9 COMMAND AIRSPEED	10 COMMAND AIRSPEED
AIRCRAFT	F-15	CL-84	AV-8A	MIL-B-81641(AS)	MIL-STD-884B
FIGURE NO.	5	1	6	5	5
FORM OF DISPLAY	vertical scale	symbolic	horizontal scale	vertical scale	vertical scale
LOCATION ON HUD	left edge	lower center	upper edge, left	left edge	left edge
DISPLAY LABEL	none	none	none	AS	AS
RANGE OF VARIABLE	-100 to 1023 KT		±40 KT	0 to 600 KT	
RANGE DISPLAYED	160 KT		±20 KT	100 KT	40 KT
DIRECTION OF INCREASE	down	up	right	down	down
FIXED SCALE?	no	yes	yes	no	
SCALE VALUES MARKED?	yes	no	no	yes	yes
SCALE GRADIENTATIONS	10 KT		20 KT	10 KT	5 KT
MOVING REFERENCE?	yes	yes	yes	yes	
TYPE OF REFERENCE	horizontal line	diamond	vertical line	caret	caret
MODES IN WHICH FUNCTION IS AVAILABLE	all	approach; transition	all exc. V/STOL, A/A	TO/NAV; TF; bomb- ing; borsight weapons; guided weapons; LDC	T/O; NAV; TF/TA; weapon delivery; landing
DISPLAY CHANGES WITH MODE CHANGES	display position changes with gear up/down change	displays approach speed error in APPR, speed in TRAN	none	none	none
NOTES	low resolution mode gives 320 KT display range, 20 KT resolution	diamond to be flown to dot		when caret lines up with fixed in- dex at center of scale, command is satisfied	

NUMBER	11	12	13	14	15
FUNCTION	DISPLAY AIRSPEED	DISPLAY AIRSPEED	DISPLAY AIRSPEED	DISPLAY IAS	DISPLAY IAS
AIRCRAFT	CL-84	MIL-D-81641(AS)	MIL-STD-884B	A-7	F-14
FIGURE NO.		5	5	7	3
FORM OF DISPLAY	digital	vertical scale	vertical scale	vertical scale	vertical scale
LOCATION ON HUD	left upper quadrant	left edge	left edge	left edge	left edge
DISPLAY LABEL	none	A	AS	none	none
RANGE OF VARIABLE		0 to 600 KT			
RANGE DISPLAYED		100 KT	40 KT	100 KT	100 KT
DIRECTION OF INCREASE		down	down	up	up
FIXED SCALE?		no		yes	yes
SCALE VALUES MARKED?		yes	yes	no	no
SCALE GRADUATIONS		10 KT	5 KT	10 KT	10 KT
MOVING REFERENCE?		no		yes	yes
TYPE OF REFERENCE		horizontal line	horizontal line	"thermometer"	"thermometer"
MODES IN WHICH FUNCTION IS AVAILABLE	approach; transition	TO/NAV; IF; bombing; bore-sight & guided weapons; landing	T/O; NAV; IF/TA; weapon delivery; landing	all	all
DISPLAY CHANGES WITH MODE CHANGES	none	none	none	none	none
NOTES	speed diamond also used in transition to indicate ground speed re runway (see no. 7)			numeric at bottom of display indicates hundreds of KT to which scale value is added	numeric at bottom of scale indicates hundreds of KT to which scale value is added

NUMBER	16	17	18	19	19 (cont)
FUNCTION	DISPLAY IAS	DISPLAY IAS	DISPLAY TAS	AIR-TO-AIR ATTACK STEERING	AIR-TO-AIR ATTACK STEERING
AIRCRAFT	F-15	AV-8A	AV-8A	F-14	F-14
FIGURE NO.	5			8	9
FORM OF DISPLAY	vertical scale	digital	digital	symbolic	symbolic
LOCATION ON HUD	left edge	upper edge, left	upper edge, left	reticle in center	
DISPLAY LABEL	none	none	"	none	none
RANGE OF VARIABLE	-100 to 1023 KT	30 to 660 KT	230 to 750 KT		
RANGE DISPLAYED	160 KT				
DIRECTION OF INCREASE	down				
FIXED SCALE?	no				
SCALE VALUES MARKED?	yes				
SCALE GRADUATIONS	10 KT	1 KT	1 KT		
MOVING REFERENCE?	no				
TYPE OF REFERENCE	caret				
HUES IN WHICH FUNCTION IS AVAILABLE	all	all exc. A/A (V/STOL and NAV only in aircraft after A/C 105)	WPNB; WPNBb	A/A Sidelander WPNB; Sparrow norm; A/A Phoenix norm	A/A Phoenix norm; Sparrow norm
DISPLAY CHANGES WITH MODE CHANGES	display shifts with gear extension	none	none	note	none
NOTES	low resolution gives 320 KT display range, 20 KT grad- uations. caret shown in fig- ure should be at midpoint of scale	demand speed dis- played at same loc- ation when SET SPEED knob pushed. demand speed can be changed by turn- ing knob. see no. 8. updated 2X/sec	update 2X/sec. same location as IAS with "V" to indicate TAS	target designator present in side- winder mode; steer- ing toe present in Sparrow & Phoenix modes. aircraft reticle and target designator or steering toe mis- alignment in steer- ing command	Fly velocity vec- tor to flight director. dot in center of PB in- dicates a/c course more than 90° from command course ref. 4

NUMBER	19 (cont)	20	21	21(cont)	22
FUNCTION	AIR-TO-AIR ATTACK STEERING	AIR-TO-AIR ATTACK STEERING	AIR-TO-GROUND ATTACK STEERING	AIR-TO-GROUND ATTACK STEERING	AIR-TO-GROUND ATTACK STEERING
AIRCRAFT	F-14	F-15	F-14	F-14	F-14
FIGURE NO.	10	12	13	9	14
TURN OF DISPLAY	symbolic	symbolic	symbolic	symbolic	symbolic
LOCATION ON HUD					
DISPLAY LABEL	none	none	none	none	none
RANGE OF VARIABLE					
RANGE DISPLAYED					
DIRECTION OF INCREASE					
FIXED SCALE?					
SCALE VALUES MARKED?					
SCALE GRADUATIONS					
MOVING REFERENCE?					
TYPE OF REFERENCE					
MODES IN WHICH FUNCTION IS AVAILABLE	Sparrow norm; A/A Sidewinder norm	A/A (missile)	A/G computer-IP A/G computer-TGT	A/G computer-TGT A/G computer-IP	A/G
DISPLAY CHANGES WITH MODE CHANGES	size of dashed reticle changes	none	none	none	none
NOTES	fixed reticle at ADL. fly moveable reticle into fixed reticle. AMG-14 ref 4	fly steering dot into ASE circle		azimuth separation of TD and VV indic- ates steering error ref. 4	

NUMBER	23	24	25	26	27
FUNCTION	AIR-TO-GROUND ATTACK STEERING	COMMAND ALTITUDE	COMMAND ALTITUDE2	COMMAND ALTITUDE	COMMAND ALTITUDE
AIRCRAFT	F-111A	F-14	F-15	MC-130 (AS)	MIL-STD-883B
FIGURE NO.	15	16	17	17	17
FORM OF DISPLAY	symbolic	digital	vertical scale	vertical scale	vertical scale
LOCATION ON HUD		right edge	right edge	right edge	right edge
DISPLAY LABEL	none	none	none	B or R	B or R
RANGE OF VARIABLE			-1000 to 80,000 FT	note	
RANGE DISPLAYED			1500 FT (note)	1000 FT	1000 FT
DIRECTION OF INCREASE			up	down	up
FIXED SCALE?			no	no	
SCALE VALUES MARKED?			yes	yes	yes
SCALE GRADUATIONS		1000 FT	100 FT (note)	100 FT	100 FT
MOVING REFERENCE?			yes	yes	
TYPE OF REFERENCE			horizontal line	caret	caret
HOOKS IN WHICH FUNCTION IS AVAILABLE	command	all	all	TO/NAV; T; bomb- ing; landing	all
DISPLAY CHANGES WITH MODE CHANGES	none	none	display shifts when gear extended. high resolution.	none	none
NOTES	reticle is red; steering bars, green. steer bars to pip- per	Data Link command ref. 4	300 FT display range with high resolution select- ed. 20 FT scale markings with high resolution select- ed.	BARD ALT range -1000 FT to ALT. designated in de- tail A/C SPEC. re- tail ALT range 0 FT to ALT designated. illustration in SPEC shows larger values at bottom of scale (vice fig- ure 17)	

NUMBER	28	29	29(cont)	30	31
FUNCTION	DISPLAY BAROMETRIC ALTITUDE	DISPLAY BAROMETRIC ALTITUDE	DISPLAY BAROMETRIC ALTITUDE	DISPLAY BAROMETRIC ALTITUDE	DISPLAY BAROMETRIC ALTITUDE
AIRCRAFT	A-7	F-14	F-14	F-15	AV-8A
FIGURE NO.	16	16	16	17	
FORM OF DISPLAY	vertical scale	vertical scale	vertical scale	vertical scale	digital
LOCATION ON HUD	right edge	right edge	right edge	right edge	upper edge, right
DISPLAY LABEL	none	none	none	none	none
RANGE OF VARIABLE		0 to 14000 FT		-1000 to 80000 FT	-1000 to 59950 FT
RANGE DISPLAYED	1000 FT	0 to 14000 FT	1000 FT	1500 FT (note)	
DIRECTION OF INCREASE	up	up	up	up	
FIXED SCALE?	yes	yes	yes	no	
SCALE VALUES PARKED?	no	yes	no	yes	
SCALE ORIGINATIONS	100 FT	2000 FT	100 FT	100 FT (note)	20 FT (note)
MOVING REFERENCE?	yes	yes	yes	no	
TYPE OF REFERENCE	"thermometer"	caret	"thermometer"	caret	
MODES IN WHICH FUNCTION IS AVAILABLE	en route navigation, landing	A/G	all	all	all exc. A/A
DISPLAY CHANGES WITH MODE CHANGES	none	none	none	display shifts with gear extension, high resolution	none
NOTES	numeric at bottom of scale indicates thousands of feet.		numeric at bottom of scale indicates thousands of feet. ref. 4	300 FT display range with high resolution select-ed. 20 FT scale markings with high resolution select-ed.	50 FT above 10000 FT

NUMBER	32	33	34	35	35(cont)
FUNCTION	DISPLAY BAROMETRIC ALTITUDE	DISPLAY BAROMETRIC ALTITUDE	DISPLAY RADAR ALTITUDE	DISPLAY RADAR ALTITUDE	DISPLAY RADAR ALTITUDE
AIRCRAFT	MIL-D-81641(AS)	MIL-STD-884B	A-7	F-14	F-14
FIGURE NO.	17	17	16	13	16
FORM OF DISPLAY	vertical scale	vertical scale	vertical scale	vertical scale	vertical scale
LOCATION ON HUD	right edge	right edge	right edge	right edge	right edge
DISPLAY LABEL	B		note	none	note
RANGE OF VARIABLE	note			1400 FT	
RANGE DISPLAYED	1000 FT	1000 FT	1000 FT	1400 FT	1000 FT
DIRECTION OF INCREASE	down	up	up	up	up
FIXED SCALE?	no		yes	yes	yes
SCALE VALUES MARKED?	yes	yes	no	yes	no
SCALE GRADUATIONS	100 FT	100 FT	100 FT	200 FT	100 FT
MOVING REFERENCE?	no		yes	yes	yes
TYPE OF REFERENCE	horizontal line	horizontal line	"thermometer"	care:	"thermometer"
MODES IN WHICH FUNCTION IS AVAILABLE	TO/NAV; TP; Bombing; landing	all	attack; IF	takeoff; landing	all
DISPLAY CHANGES WITH MODE CHANGES	none	none	none	none	none
NOTES	-1000 FT to altitude designated in A/C detail SPEC.		numeric at bottom of scale indicates thousands of feet. half box enclosing value denotes radar altitude.	scale marking is 1 vice 10 (see figure 18)	numeric at bottom of scale indicates thousands of feet. half box around this value denotes radar altitude. ref. 4



NUMBER	36	37	38	39	40
FUNCTION	DISPLAY RADAR ALTITUDE	DISPLAY RADAR ALTITUDE	DISPLAY RADAR ALTITUDE	DISPLAY RADAR ALTITUDE	DISPLAY ANGLE OF ATTACK
AIRCRAFT	CL-84	AV-8A	MIL-D-81641(AS)	MIL-STD-884B	F-15
FIGURE NO.			17	17	5
FORM OF DISPLAY	digital	digital	vertical scale	vertical scale	vertical scale
LOCATION ON HUD	upper R quadrant	upper edge, right	right edge	right edge	left side, lower
DISPLAY LABEL	none	note	R	R	none
RANGE OF VARIABLE		0 to 5000 FT	note		0 to 45 units
RANGE DISPLAYED			1000 FT	1000 FT	0 to 45 units
DIRECTION OF INCREASE			down	up	up
FIXED SCALE?			no		yes
SCALE VALUES MARKED?			yes	yes	yes
SCALE GRADUATIONS		5 FT	100 FT	100 FT	5 units
MOVING REFERENCE?			no		yes
TYPE OF REFERENCE			horizontal line	horizontal line	caret
HOLES IN WHICH FUNCTION IS AVAILABLE	approach; transition	all exc. A/A	TO/NAV; IF; bombing; landing	all	ADI
DISPLAY CHANGES WITH HOSE CHANGES	none	none	none	none	display shifts with gear extended
NOTES	numerals preceded by C to indicate height above ground	numerals prefixed by R to indicate radar altitude	0 FT to altitude designated in A/C detail SPEC.		

NICKER	41	42	43	43 (cont)	44
FUNCTION	DISPLAY ANGLE OF ATTACK	DISPLAY ANGLE OF ATTACK ERROR	DISPLAY ANGLE OF ATTACK ERROR	DISPLAY ANGLE OF ATTACK ERROR	DISPLAY ANGLE OF ATTACK ERROR
ATTACK	AV-8A	A-7	F-14	F-14	HTL-D-81641(AS)
FIGURE NO.	19	20	21	20	21
FORM OF DISPLAY	vertical scale	symbolic	symbolic	symbolic	symbolic
LOCATION ON HUD	left edge				
DISPLAY LABEL	none	none	none	none	none
RANGE OF VARIABLE	-5 to 20 units				
RANGE DISPLAYED	-5 to 20 units				NOTE
DIRECTION OF INCREASE	up				
FIXED SCALE?	yes				
SCALE VALUES MARKED?	no				
SCALE GRADUATIONS	4 units				
MOVING REFERENCE?	yes				
TYPE OF REFERENCE	"thermo" with caret				
MODES IN WHICH FUNCTION IS AVAILABLE	all	all	landing	landing	landing
DISPLAY CHANGES WITH MODE CHANGES	none	none	none	none	none
NOTES	displays angle in degrees at air- speeds > 120 KT, units at airspeeds < 100 KT (prior to AFC 105 only).	fly flight path marker away from center of bracket to obtain centering available when ADA > 14 units.	fly A/C to center bar of bracket	fly A/C to center bar of bracket. ref. 4	fly A/C to center of bracket. bracket is 4 units high.

NUMBER	45	46	47	47(cont)	48
FUNCTION	DISPLAY ANGLE OF ATTACK ERROR	DISPLAY OPTIMUM ANGLE OF ATTACK	DISPLAY ARMAMENT DATUM LINE	DISPLAY ARMAMENT DATUM LINE	DISPLAY ARMAMENT DATUM LINE
AIRCRAFT	MIL-STD-884B	F-15	F-14	F-14	F-15
FIGURE NO.	21	5	22	22	22
FORM OF DISPLAY	symbolic	vertical scale	symbolic	symbolic	symbolic
LOCATION ON HUD		left side, lower	5" above A/G reticle		
DISPLAY LABEL	none	none	none	none	none
RANGE OF VARIABLE		0 to 45 units			
VALUE DISPLAYED		0 to 45 units			
DIRECTION OF INCREASE		up			
FIXED SCALE?		yes			
SCALE VALUES MARKED?		yes			
SCALE GRADUATIONS		5 units			
MOVING REFERENCE?		yes			
TYPE OF REFERENCE		horizontal line			
MODES IN WHICH FUNCTION IS AVAILABLE	all	ADI	A/A (all); A/G COMP-PILOT (both); A/G manual	A/A: Sidewinder- boresight, Phoenix- boresight, Sparrow- boresight; A/G COMP-PILOT (both)	all
DISPLAY CHANGES WITH MODE CHANGES	none	display shifts with gear extended	none	none	none
NOTES				ref. 4	appears when mes- ter arm on and serves as an in- dicator of master arm status

NUMBER	49	50	51	52	52(cont)
FUNCTION	DISPLAY ARMAMENT DATUM LINE	DISPLAY ARMAMENT DATUM LINE	DISPLAY ARMAMENT DATUM LINE	DISPLAY ARMAMENT SELECTION	DISPLAY ARMAMENT SELECTION
AIRCRAFT	AV-8A	MIL-D-81641(AS)	MIL-STD-884B	F-14	F-14
FIGURE NO.	22	22	22		
FORM OF DISPLAY	symbolic	symbolic	symbolic	alphanumeric	alphanumeric
LOCATION ON HUD	at A/C FRL				bottom
DISPLAY LABEL	none	BS	none	note	note
RANGE OF VARIABLE					
RANGE DISPLAYED					
DIRECTION OF INCREASE					
FIXED SCALE?					
SCALE VALUES MARKED?					
SCALE GRADUATIONS					
MOVING REFERENCE?					note
TYPE OF REFERENCE					caret
MODES IN WHICH FUNCTION IS AVAILABLE	WPNS a; WPNS b	boresight	WPN delivery	all exc. TO, land- ing	
DISPLAY CHANGES WITH MODE CHANGES	none	none	none	none	none
NOTES				ORD: bombs or rock- ets; G: gun; SW: Sidewinder; SP: Sparrow; PH: Phoe- nix. number under C is number of hundred rounds remaining. number under PH is number of missiles ready	3 line message: top: type weapon selected middle: ready weap- ons loaded lower: rounds re- maining (100's). caret points to weapons selected ref. 4

NUMBER	53	54	55	56	56(cont)
FUNCTION	DISPLAY ARMAMENT SELECTION	DISPLAY ARMAMENT SELECTION	DISPLAY ARMAMENT SELECTION	DISPLAY ATTITUDE	DISPLAY ATTITUDE
AIRCRAFT	MIL-D-31641(AS)	F-15	MIL-STD-884B	F-14	F-14
FIGURE NO.				23	24
FORM OF DISPLAY	alphanumeric	digital	alphanumeric	ladder/symbolic	ladder/symbolic
LOCATION ON HUD		lower edge, L scale			
DISPLAY LABEL	note	note	none	none	none
RANGE OF VARIABLE				290'	290'
RANGE DISPLAYED				80'	20"
DIRECTION OF INCREASE				up	up
FIXED SCALE?				no	no
SCALE VALUES MARKED?				yes	yes
SCALE GRADUATIONS				30"	note
MOVING REFERENCE?				yes	yes
TYPE OF REFERENCE				A/C reticle	A/C reticle
MODES IN WHICH FUNCTION IS AVAILABLE	TP; boresight WPNS; guided WPNS; bore- sight	A/A (both); A/G	weapon delivery	A/A; cruise	A/G; takeoff; land- ing
DISPLAY CHANGES WITH MODE CHANGES	none	none	none	scale change	none
NOTES	missile, guns, rockets: number of missiles ready, number of rounds remaining (100's), number of rockets remaining (10's)	type and number of missiles, rounds remaining ref. 6			divisions are 5' up to 230', 10' thereafter

NUMBER	56(cont)	37	58	59	60
FUNCTION	DISPLAY ATTITUDE	DISPLAY ATTITUDE	DISPLAY ATTITUDE	DISPLAY ATTITUDE	DISPLAY ATTITUDE
AIRCRAFT	F-14	F-15	F-111A	CL-84	AV-8A
FIGURE NO.	26	25	15	1	27
FORM OF DISPLAY	ladder/symbolic	ladder/symbolic	vertical scale/SYM	ladder/symbolic	ladder/symbolic
LOCATION ON HUD			note	see figure 1	
DISPLAY LABEL	none	none	none	none	none
RANGE OF VARIABLE	$\pm 90^\circ$	$360^\circ$			$\pm 90^\circ$
RANGE DISPLAYED	$20^\circ$	note	$210^\circ$ pitch, $360^\circ$ roll	$5^\circ$	$50^\circ$
DIRECTION OF INCREASE	up	note		up	up
FIXED SCALE?	no	no	yes	no	no
SCALE VALUES MARKED?	yes	yes (note)	no	yes	yes
SCALE GRADUATIONS	$5^\circ$	note	$2.5^\circ$	$5^\circ$	$30^\circ$
MOVING REFERENCE?	yes	yes	yes	no	yes
TYPE OF REFERENCE	velocity vector	A/C symbol	horizontal line		A/C symbol
MODES IN WHICH FUNCTION IS AVAILABLE		all	all	approach; transition	V/STOL
DISPLAY CHANGES WITH MODE CHANGES		none	note	none	none
NOTES	ref. 4	scale divisions at $5^\circ$ , numbers up to $30^\circ$ , above $30^\circ$ line spacing compressed. when $90^\circ$ pitch exceeded, numbers decrease toward zero. zenith, nadir, & A/C symbols in FIG. 25. display as in FIG. 26, exc. signs missing	pitch indicator represents deviation from value preset by pilot. roll available in all modes; pitch, roll is in reticle, pitch at left edge		

NUMBER	61	62	63	64	65
FUNCTION	DISPLAY ATTITUDE	DISPLAY ATTITUDE	COMMAND BANK ANGLE	DISPLAY BOMB FALL LINE	DISPLAY BOMB FALL LINE
AIRCRAFT	MIL-D-81641(AS)	MIL-STD-884B	F-14	A-7	F-14
FIGURE NO.	26	26	28	13	13
FORM OF DISPLAY	ladder/symbolic	ladder/symbolic	symbolic	symbolic	symbolic
LOCATION ON HUD					
DISPLAY LABEL	none	none	none	none	none
RANGE OF VARIABLE	190°				
RANGE DISPLAYED	30°	30°			
DIRECTION OF INCREASE	up	up			
FIXED SCALE?	no	no			
SCALE VALUES MARKED?	yes	yes			
SCALE GRADUATIONS	5°	5°			
MOVING REFERENCE?	yes	yes			
TYPE OF REFERENCE	A/C reticle	A/C reticle			
MODES IN WHICH FUNCTION IS AVAILABLE	all exc. boresight	all	attack; landing; A/G	attack modes exc. guns, rockets	A/C COMP-TGT; A/G COMP-PILOT (beamb) A/G COMP-IF
DISPLAY CHANGES WITH MODE CHANGES	pitch lines absent in TF	none	none	none	none
NOTES	A/C reticle shown in FIG. 26. pitch lines marked every 10° (with first digit). negative sign present		ref. 4	parallel to or coincident with a line between FTH and impact point	

NUMBER	64	67	68	69	70
FUNCTION	DISPLAY BOB FALL LINE	DISPLAY BOB FALL LINE	DISPLAY BOB FALL LINE	COMMAND BREAKAWAY	COMMAND BREAKAWAY
AIRCRAFT					
FIGURE NO.	F-15 13	MIL-D-81641(AS) 13	MIL-STD-884B 13	A-7 29	F-14 29
FORM OF DISPLAY	symbolic	symbolic	symbolic	symbolic	symbolic
LOCATION ON HUD					
DISPLAY LABEL	none	none	none	none	none
RANGE OF VARIABLE					
RANGE DISPLAYED					
DIRECTION OF INCREASE					
FIXED SCALE?					
SCALE VALUES MARKED?					
SCALE GRADATIONS					
MOVING REFERENCE?					
TYPE OF REFERENCE					
MODES IN WHICH FUNCTION IS AVAILABLE	A/G	bombing	weapon delivery	attack; TP; land- ing	cruise vector; A/A optical track; A/A normal; all A/G exc. manual; land- ing/ALT; LDC/vector
DISPLAY CHANGES WITH MODE CHANGES	none	none	none	none	none
NOTES				located at position of FPN. flashes 5 times/sec	located at center FOV. flashes 3 times/sec



NUMBER	71	72	73	74	75
FUNCTION	COMMAND BREAKAWAY	COMMAND BREAKAWAY	COMMAND BREAKAWAY	COMMAND BREAKAWAY	COMMAND CLOSURE
AIRCRAFT	F-15	A7-8A	MIL-D-81641 (AS)	MIL-STD-884B	DATE
FIGURE NO.	29	29	29	29	17
FORM OF DISPLAY	symbolic	symbolic	symbolic	symbolic	vertical scale
LOCATION ON HUD		note			right edge
DISPLAY LABEL	none	none	none	none	C
RANGE OF VARIABLE					-1000 to 1000 KT
RANGE DISPLAYED					200 KT
DIRECTION OF INCREASE					down
FIXED SCALE?					no
SCALE VALUES MARKED?					yes
SCALE GRADUATIONS					20 KT
MOVING REFERENCE?					yes
TYPE OF REFERENCE					center
MODES IN WHICH FUNCTION IS AVAILABLE	A/A missile	weapons b	all exc. boresight	TF/TA; weapons delivery; landing	boresight weapons; guided weapons
DISPLAY CHANGES WITH MODE CHANGES	none	none	none	none	none
NOTES		centered on CCIF cue	flashes 4 times/sec	flashes	

NUMBER FUNCTION	76		76(cont)		77		78		79	
	DISPLAY CLOSURE RATE		DISPLAY CLOSURE RATE		DISPLAY CLOSURE RATE		DISPLAY CLOSURE RATE		DISPLAY CLOSURE RATE	
AIRCRAFT	F-14		F-14		F-15		MIL-D-81641(AS)		MIL-STD-884B	
FIGURE NO.	30		55		55		17		17	
FORM OF DISPLAY	vertical scale		digital (signed)		digital		vertical scale		vertical scale	
LOCATION ON HUC	left edge		left side (note)		right side (note)		right edge		left edge	
DISPLAY LABEL	none		none		none		C		∠	
RANGE OF VARIABLE	-200 to 1000 KT						-1000 to 1000 KI			
RANGE DISPLAYED	1200 KI						200 KI		160 KI	
DIRECTION OF INCREASE	up						down		down	
FIXED SCALE?	yes						no		no	
SCALE VALUES MARKED?	yes						yes		yes	
SCALE GRADUATIONS	200 KI		10 KI				20 KI		20 KI	
MARKING REFERENCE?	yes						no		no	
TYPE OF REFERENCE	caret						horizontal line		horizontal line	
MODES IN WHICH FUNCTION IS AVAILABLE	A/A Sidewinder normal; A/A Side- winder boresight; A/A optical track; A/A Phoenix normal; A/A Sparrow normal				A/A		boresight weapons; guided weapons		weapon delivery	
DISPLAY CUMULUS WITH MODE CHANGES	none		none		display shifts with gear exten- sion		none		none	
NOTES			sign and numerals appear to right of caret indicating target range on range scale ref. 4		numerals appear to left of caret in- dicating target range on range scale					

NUMBER	80	81	81(cont)	81(cont)	82
FUNCTION	COMMAND COURSE	COMMAND COURSE	COMMAND COURSE	COMMAND COURSE	COMMAND COURSE
AIRCRAFT	A-7	F-14	F-14	F-14	F-13
FIGURE NO.	9	5	31	9	32
FORM OF DISPLAY	symbolic	symbolic	symbolic	symbolic	symbolic
LOCATION ON HUD					
DISPLAY LABEL	none	none	none	none	note
RANGE OF VARIABLE					
RANGE DISPLAYED			2°		note
DIRECTION OF INCREASE					
FIXED SCALE?					
SCALE VALUES MARKED?					
SCALE GRADUATIONS					
MOVING REFERENCE?					
TYPE OF REFERENCE					
MODES IN WHICH FUNCTION IS AVAILABLE	TF; en route navigation	cruise/TACAN; A/A Sparrow normal; A/A Phoenix normal	landing/AML; A/G PCD	landing/AML; all cruise exc. manual	ADI
DISPLAY CHANGES WITH MODE CHANGES	no vertical commands in navigation mode	none	none	none	none
NOTES	FD indicates steering error with respect to FPN (velocity vector)	align vertex of tee with A/C reticle dot	center crossed pointers	fly velocity vector to FD ref. 4	NAV indicates INS steering. TCN indicates TACAN. bank angle steering provided by vertical bar of FD. ILS indicates glide slope command is given by FD. present if A/C within .6° of glide slope ref. 6

NUMBER	83	84	85	86	87
FUNCTION	COMMAND COURSE	COMMAND COURSE	INDICATE DESTINATION	DISPLAY ENGINE TORQUE	DISPLAY FLAP STATUS
AIRWEIGHT	P-111A	MIL-D-81641(AS)	P-15	CL-84	F-14
FIGURE NO.	15	8			
FORM OF DISPLAY	symbolic	symbolic	digital	digital	note
LOCATION ON HUD			bottom of R scales	lower right	lower right
DISPLAY LABEL	none	none	none	none	none
RANGE OF VARIABLE					
RANGE DISPLAYED	note				
DIRECTION OF INCREASE					
FIXED SCALE?					
SCALE VALUES MARKED?					
SCALE GRADUATIONS					
MOVING REFERENCE?					
TYPE OF REFERENCE					
MODES IN WHICH FUNCTION IS AVAILABLE	command	takeoff/navigation	ADI	approach	
DISPLAY CHANGES WITH MODE CHANGES	none	none	display shifts with gear extension	none	none
NOTES	ILS, AILA: left deviation indicator shows glide slope deviation. full scale = .7° fly bars to pipper	when PD centered in aperture of velocity vector, steering command is satisfied	number in window indicates INS destination selected ref. 6		line appears over wing sweep indicator when flaps extended ref. 4

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WINGMAN	88	88(cont)	89	90	91
FUNCTION	DISPLAY FLIGHT PATH ANGLE	DISPLAY FLIGHT PATH ANGLE	DISPLAY FLIGHT PATH ANGLE	DISPLAY FLIGHT PATH ANGLE	DISPLAY FLIGHT PATH ANGLE
AIRCRAFT	A-7	A-7	F-14	F-15	A7-8A
FIGURE NO.	26	33	26	26	27
FORCE OF DISPLAY	ladder/symbolic	symbolic	ladder/symbolic	ladder/symbolic	ladder/symbolic
LOCATION ON TRUE					
DISPLAY LABEL	none	none	none	none	none
RANGE OF VARIABLE				360°	±90°
RANGE DISPLAYED	10°		20°	note	30°
DIRECTION OF INCREASE	up		up	note	up
FIXED SCALE?	no		no	no	no
SCALE VALUES MARKED?	yes		yes	yes (note)	yes
SCALE ORIGINATIONS	5°		5°	note	30°
MOVING REFERENCE?	yes		yes	yes	yes
TYPE OF REFERENCE	flight path marker		velocity vector	velocity vector	A/C symbol
MODES IN WHICH FUNCTION IS AVAILABLE	all exc. landing	landing		all	GEN; navigation
DISPLAY CHANGES WITH MODE CHANGES	none	none	none	none	none
NOTES		A/C on glide slope and on C/L when FD centered in FPM		scale divisions at 5°, numbered up to 30°, above 30° line spacing compressed, when 90° pitch ex- ceeded, numbers de- crease toward zero. zenith, nadir as in figure 25. display as in figure 25, exc. signs missing	

SUBJECT	92	92 (cont)	93	94	95
FUNCTION	DISPLAY GLIDE SLOPE ERROR	DISPLAY GLIDE SLOPE ERROR	DISPLAY GUIDE SLOPE ERROR	DISPLAY GLIDE SLOPE ERROR	DISPLAY GROUND SPEED
AIRCRAFT	F-14	F-14	F-11A	CL-84	CL-84
FIGURE NO.	31	8	13	1	
FORM OF DISPLAY	symbolic	symbolic	vertical scale	symbolic	digital
LOCATION ON HUD			left edge	lower center	upper L quadrant
DISPLAY LABEL	none	none	none	none	none
RANGE OF VARIABLE					
RANGE DISPLAYED	22°		2.7°		
DIRECTION OF INCREASE				up	
FIXED SCALE?			yes		
SCALE VALUES MARKED?			no		
SCALE GRADUATIONS			.175°		
MOVING REFERENCE?			yes		
TYPE OF REFERENCE			horizontal line		
MODES IN WHICH FUNCTION IS AVAILABLE	landing/ANL	landing/ANL	command	approach	approach; transi- tion
DISPLAY CHANGES WITH MODE CHANGES	none	none	none	none	none
NOTES	center crossed pointers	target designator. if glide slope er- ror is zero, sym- bol is 36 minutes above ADL ref. 4	for LS and ALA	deviation from glide slope is represented by deviation of speed diamond from ap- proach aim point	speed diamond used in transition to indicate ground speed with respect to runway C/L (see no. 11)

NUMBER	96	97	98	99	99(cont)
FUNCTION	DISPLAY GROUND SPEED	GUN AIMING SYMBOL	GUN AIMING SYMBOL	GUN AIMING SYMBOL	GUN AIMING SYMBOL
AIRCRAFT FIGURE NO.	AV-3A	A-7	F-5	F-14	F-14
FORM OF DISPLAY	34	35	4	10	36
LOCATION ON HUD	horizontal scale	symbolic	symbolic	symbolic	symbolic
DISPLAY LABEL	upper edge, left				
RANGE OF VARIABLE	none	none	none	none	none
RANGE DISPLAYED	130 KT				
DIRECTION OF INCREASE	60 KT				
FIXED SCALE?	right				
SCALE VALUES MARKED?	yes				
SCALE GRADUATIONS	no				
AIMING REFERENCE?	15 KT				
TYPE OF REFERENCE	yes				
MODES IN WHICH FUNCTION IS AVAILABLE	vertical line				
	V/STOL	gun; rocket	guns	A/A manual gun; A/A optical track	A/A manual gun; A/A optical track; A/G COMBAT-PILOT (guns, rockets)
DISPLAY CHANGES WITH MODE CHANGES	none	none	none	none	none
NOTES	prior to AFC 105. pointer removed if ground speed > 130 KT			moveable reticle	ref. 4

NUMBER	99 (cont)	100	101	102	103
FUNCTION	GUN AIMING SYMBOL	GUN AIMING SYMBOL	GUN AIMING SYMBOL	COMMAND HEADING	COMMAND HEADING
AIRCRAFT	F-16	F-15	AV-8A	F-15	CL-84
FIGURE NO.	10	11	37	38	1
FORM OF DISPLAY	symbolic	symbolic	symbolic	horizontal scale	symbolic
LOCATION ON HUD				top edge	upper, lower edges
DISPLAY LABEL	none	none	none	none	none
RANGE OF VARIABLE				360°	360°
RANGE DISPLAYED				30°	28.5°
DIRECTION OF INCREASE				L to R	
FIXED SCALE?				no	yes
SCALE VALUES MARKED?				yes	no
SCALE GRADUATIONS				2°	
HAVING REFERENCE?				yes	yes
TYPE OF REFERENCE				vertical line	caret
MODES IN WHICH FUNCTION IS AVAILABLE	A/A optical track	A/A gun	all exc. V/STOL	all	approach
DISPLAY CHANGES WITH MODE CHANGES	none	none	none	none	none
NOTES	(fixed reticle) ref. 4 AWC-14		after APC 105		caret and open circle in center of deviation bar indicate runway heading



NUMBER	104	105	106	107	107(cont)
FUNCTION	COMMAND HEADING	COMMAND HEADING	DISPLAY HEADING	DISPLAY HEADING	DISPLAY HEADING
AIRCRAFT	MIL-D-81641(AS)	MIL-STD-884B	A-7	F-14	F-14
FIGURE NO.	38	38	39	40	41
FORM OF DISPLAY	horizontal scale	horizontal scale	horizontal scale	horizontal scale	horizontal scale
LOCATION ON HUD	top edge	top edge	top edge	top edge	top edge
DISPLAY LABEL	none	none	none	none	none
RANGE OF VARIABLE	360°	360°	360°	360°	360°
RANGE DISPLAYED	50°	40°	20°	30°	30°
DIRECTION OF INCREASE	L to R	L to R	L to R	L to R	L to R
FIXED SCALE?	no	no	no	no	no
SCALE VALUES MARKED?	yes	yes	yes	yes	yes
SCALE GRADUATIONS	5°	5°	5°	5°	5°
MOVING REFERENCE?	yes	yes	no	no	no
TYPE OF REFERENCE	caret	caret	vertical line	caret	caret
MODES IN WHICH FUNCTION IS AVAILABLE	all exc. boresight	all	all	all exc. A/A	all exc. boresight missile
DISPLAY CHANGES WITH HUD CHANGES	none	none	none	none	moves to bottom of HUD in landing/takeoff
NOTES					ref. 4

FUNCTION	108		109		110		111		112	
	DISPLAY HEADING		DISPLAY HEADING		DISPLAY HEADING		DISPLAY HEADING		DISPLAY HEADING	
AIRCRAFT	F-15		CL-84		AV-8A		MIL-D-81641(AS)		MIL-STD-884B	
FIGURE NO.	38		1		39		38		38	
FORM OF DISPLAY	horizontal scale		horizontal scale		horizontal scale		horizontal scale		horizontal scale	
LOCATION ON HUD	top edge		top edge		below center		top edge		top edge	
DISPLAY LABEL	none		none		none		none		none	
RANGE OF VARIABLE	360°		360°		360°		360°		360°	
RANGE DISPLAYED	30°				20°		30°		40°	
DIRECTION OF INCREASE	L to R				L to R		L to R		L to R	
FIXED SCALE?	no		yes		no		no		no	
SCALE VALUES MARKED?	yes		no		yes		yes		yes	
SCALE GRADUATIONS	2°		none		5°		5°		5°	
MOVING REFERENCE?	no		no		no		no		no	
TYPE OF REFERENCE	caret		vertical line		vertical line		vertical line		vertical line	
MODES IN WHICH FUNCTION IS AVAILABLE	all		approach; transition		V/STOL; GEN (before AFC 105); navigation		all exc. boresight		all	
DISPLAY CHANGES WITH MODE CHANGES	none		none		none		none		none	
NOTES			a digital display also appears in center							

SUPPLIER	113	114	115	115(cont)	116
FUNCTION	DISPLAY IMPACT POINT	DISPLAY IMPACT POINT	DISPLAY IMPACT POINT	DISPLAY IMPACT POINT	CORWARD MACH NUMBER
AIRCRAFT	P-14	AV-8A	MIL-D-81641(AS)	MIL-D-81641(AS)	P-14
FIGURE NO.	10	42	10	35	3
FORM OF DISPLAY	symbolic	symbolic	symbolic	symbolic	digital
LOCATION ON HUD					top of left scale
DISPLAY LABEL	none	none	none	none	none
RANGE OF VARIABLE					
RANGE DISPLAYED					
DIRECTION OF INCREASE					
FIXED SCALE?					
SCALE VALUES MARKED?					
SCALE GRADUATIONS					
MOVING REFERENCE?					
TYPE OF REFERENCE					
MODES IN WHICH FUNCTION IS AVAILABLE	A/G exc. FOD	UPRS b	bore-sight weapons	bombing; bore-sight weapons	all exc. landing
DISPLAY CHANGES WITH MODE CHANGES	none	none	none	none	none
NOTES	(moveable reticle)	appears as a solid line when more than 18" below FEL	(moveable reticle)		number in brackets is column value ref. 4

NUMBER FUNCTION	117	118	119	120	121
	COMMAND NAME NUMBER	COMMAND NAME NUMBER	DISPLAY NAME NUMBER	DISPLAY NAME NUMBER	DISPLAY NAME NUMBER
AIRCRAFT	AV-8A	MIL-D-81641(AS)	F-14	F-15	AV-8A
FIGURE NO.	6	5	3		
FORM OF DISPLAY	horizontal scale	vertical scale	digital	digital	digital
LOCATION ON HUD	upper edge, left	left edge	top of left scale	below left scale	upper left
DISPLAY LABEL	none	M	none	none	none
RANGE OF VARIABLE	±.1 M	0 to 4 M			.30 to 1.00 M
RANGE DISPLAYED	±.05 M	1 M			.30 to 1.00 M
DIRECTION OF INCREASE	right	down			
FIXED SCALE?	yes	no			
SCALE VALUES MARKED?	no	yes			
SCALE GRADUATIONS	.05 M	.1 M		.01 M	
MOVING REFERENCE?	yes	yes			
TYPE OF REFERENCE	vertical line	caret			
MODES IN WHICH FUNCTION IS AVAILABLE	all exc. V/STOL and A/A	all exc. boresight	all exc. landing	A/A	all exc. A/A and V/STOL (before APC 105) NAV (after APC 105)
DISPLAY CHANGES WITH MODE CHANGES	none	none	none	none	none
NOTES			ref. 4	ref. 6	

NUMBER	122	123	124	125	126
FUNCTION	DISPLAY WACH NUMBER	INDICATE MASTER ARM STATUS	INDICATE MASTER ARM STATUS	INDICATE MASTER ARM STATUS	DISPLAY MISSILE TARGET
AIRCRAFT FIGURE NO.	MIL-D-81641(AS) 5	F-14 22	F-15 22	MIL-D-81641(AS)	MIL-D-81641(AS)
FORM OF DISPLAY	vertical scale	symbolic	symbolic	symbolic	symbolic
LOCATION ON HUD	left edge				
DISPLAY LABEL	M	none	none	none	none
RANGE OF VARIABLE	0 to 4 M				
RANGE DISPLAYED	1 M				
DIRECTION OF INCREASE	down				
FIXED SCALE?	no				
SCALE VALUES MARKED?	yes				
SCALE GRADUATIONS	.1 M				
MOVING REFERENCE?	no				
TYPE OF REFERENCE	horizontal line				
MODES IN WHICH FUNCTION IS AVAILABLE	all exc. boresight	cruise; A/A; A/G	all	TF; boresight weap- ons; guided weap- ons; boresight	guided weapons
DISPLAY CHANGES WITH MODE CHANGES	none	none	none	none	none
NOTES		X through armament selection display (see no. 52)	see no. 48	X through armament selection display (see no. 53)	

NUMBER	127	128	129	130	131
FUNCTION	INDICATE MISSILE TARGET STATUS	DISPLAY NAVIGATION ADVISORIES	INDICATE NAVIGATION MODE SELECTED	DISPLAY PITCH ERROR	DISPLAY RANGE TO DESTINATION
AIRCRAFT	HIL-D-81641(AS)	P-15	P-15	P-111A	P-15
FIGURE NO.	43			15	
FORM OF DISPLAY	symbolic	letters	letters	vertical scale	digital
LOCATION ON HUD		bottom L and R	lower right	left edge	lower right
DISPLAY LABEL	note	note	note	none	NAV
RANGE OF VARIABLE				$\pm 10^\circ$	
RANGE DISPLAYED				$\pm 10^\circ$	
DIRECTION OF INCREASE					
FIXED SCALE?				yes	
SCALE VALUES MARKED?				no	
SCALE GRADUATIONS				2.5°	
MOVING REFERENCE?				yes	
TYPE OF REFERENCE				horizontal line	
MODES IN WHICH FUNCTION IS AVAILABLE	guided weapons	ADI	ADI	all exc. command	ADI
DISPLAY CHANGES WITH MODE CHANGES	none	display shifts with gear extension	display shifts with gear extension	none	display shifts with gear extension
NOTES	in systems with multi-shot capa- bility, tail ap- pears when target in range, numeric indicates missile number assigned to target	"SET COURSE" "HOLD ALTITUDE" "OUTER MARKER" "MIDDLE MARKER" ref. 6	"NAV" "ILS-R" "ILS-T" "TCN" ref. 6		ref. 6

NUMBER	132	133	134	135	136
FUNCTION	DISPLAY RANGE-TO- GO TO IN-RANGE	DISPLAY RANGE-TO GO TO PULLUP POINT	DISPLAY RANGE-TO GO TO PULLUP POINT	DISPLAY RANGE-TO GO TO PULLUP POINT	DISPLAY RANGE-TO GO TO PULLUP POINT
AIRCRAFT	F-16	A-7	F-14	F-15	F-16-81661(AS)
FIGURE NO.	13	13	13	64	65
FORM OF DISPLAY	symbolic	symbolic	symbolic	symbolic	symbolic
LOCATION ON HUD					
DISPLAY LABEL	none	none	none	none	none
NAME OF VARIABLE					
RANGE DISPLAYED					
DIRECTION OF INCREASE					
FIXED SCALE?					
SCALE VALUES MARKED?					
SCALE GRADUATIONS					
MOVING REFERENCE?					
TYPE OF REFERENCE					
HOUES IN WHICH FUNCTION IS AVAILABLE	A/G computer IP; A/G computer IGT	attack exc. gun, rocket	A/G computer	A/G	bombing
DISPLAY CHANGES WITH HUD CHANGES	none	none	none	none	none
NOTES		distance of pullup cue below velocity vector represents range-to-go. upper solution cue line is actually longer than lower line. (as in figure 45)	distance of pullup cue below velocity vector represents range-to-go	distance of pullup cue below velocity vector indicates range-to-go	distance of pullup cue below velocity vector indicates range-to-go

WISHER FUNCTION	137	138	139	140	141
	DISPLAY RANGE-TO- GO TO FULLUP POINT	DISPLAY RANGE-TO- GO TO WEAPON RELEASE	DISPLAY RANGE-TO- GO TO WPN RELEASE	DISPLAY RANGE-TO- GO TO WPN RELEASE	DISPLAY RANGE-TO- GO TO WPN RELEASE
AIR SAFE	MIL-STD-284B	A-7	P-14	P-15	MIL-D-81641(AS)
FIGURE NO.	45	13	13		45
FORM OF DISPLAY	symbolic	symbolic	symbolic	symbolic	symbolic
LOCATION ON HUD					
DISPLAY LABEL	none	none	none	none	none
RANGE OF VARIABLE					
RANGE DISPLAYED					
DIRECTION OF INCREASE					
FIXED SCALE?					
SCALE VALUES MARKED?					
SCALE GRADUATIONS					
MOVING REFERENCE?					
TYPE OF REFERENCE					
HOLES IN WHICH FUNCTION IS AVAILABLE	weapon delivery	attack ext. gun, rocket	A/G computer IF; A/G computer IGT	A/G	bombing
DISPLAY CHANGES WITH HUD CHANGES	none	none	none	none	none
NOTES		upper solution cue line is longer than lower line (as in figure 45)	when upper solu- tion cue crosses velocity vector symbol, computer commands weapon release	when release cue crosses velocity vector, stores will be released	when first release cue intersects FTH, release occurs



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NUMBER	142	143	144	145	146
FUNCTION	DISPLAY RANGE-TO- GO TO WPN RELEASE	CORAND ROTATION ANGLE	DISPLAY RUNWAY IMAGE	DISPLAY RUNWAY IMAGE	DISPLAY RUNWAY IMAGE
AIRCRAFT	MIL-STD-884B	MIL-D-81641(AS)	CL-84	MIL-D-81641(AS)	MIL-STD-884B
FIGURE NO.	45	23	1	46	47
FORM OF DISPLAY	symbolic	symbolic	symbolic	symbolic	symbolic
LOCATION ON HUD					
DISPLAY LABEL	none	none	none	none	none
RANGE OF VARIABLE					
RANGE DISPLAYED					
DIRECTION OF INCREASE					
FIXED SCALE?					
SCALE VALUES MARKED?					
SCALE GRADATIONS					
MARKING REFERENCE?					
TYPE OF REFERENCE					
MODES IN WHICH FUNCTION IS AVAILABLE	weapon delivery	takeoff/navigation	approach; transi- tion	landing	landing
DISPLAY CHANGES WITH MODE CHANGES	none	none	none	none	none
NOTES		when A/C reaches rotation airspeed, flight director rises from horizon line to command angle of rotation			

NUMBER	167	167(cont)	148	149	150
FUNCTION	DISPLAY SENSOR SCAN	DISPLAY SENSOR SCAN	DISPLAY SENSOR SCAN	DISPLAY SENSOR SCAN	DISPLAY SIGHT-LINE DEFINITION CENTER
AIR RAFT	F-14	F-14	F-15	AW-14	AW-14
FEEDBACK NO.	48	8	12	49	
FORM OF DISPLAY	symbolic	symbolic	symbolic	symbolic	symbolic
LOCATION ON HUD					near A/C symbol
DISPLAY LABEL	none	none	none	none	none
RANGE OF VARIABLE					
RANGE DISPLAYED					
DIRECTION OF INCREASE					
FIXED SCALE?					
SCALE VALUES MARKED?					
SCALE GRADUATIONS					
MOVING REFERENCE?					
TYPE OF REFERENCE					
MODES IN WHICH FUNCTION IS AVAILABLE	A/A Sidewinder	A/A missiles	A/A; A/C	all am. 7/8006	none; A/C; none
DISPLAY CHANGES WITH MODE CHANGES	none	none	none	none	none
NOTES	indicates Side- winder search an- gle. on lock-on, circle disappears and dot flashes ref. 4	ref. 4		symbol positions either 2" below ABC (horizont) or moves in a circle (BEAM scan)	

NUMBER	151	152	153	154	155
FUNCTION	DISPLAY LAS ERROR	DISPLAY LAS ERROR	STANBY ARTICLE	STANBY ARTICLE	STANBY ARTICLE
AIRCRAFT	F-111A	AV-8A	A-7	F-14	MIL-D-81641(AS)
FIGURE NO.	15	6	51	52	53
FORM OF DISPLAY	vertical scale	horizontal scale	symbolic	symbolic	symbolic
LOCATION ON HUD	right edge	top edge, left		centered at ADL	
DISPLAY LABEL	none	none	none	none	none
RANGE OF VARIABLE	130 KT	±40 KT			
RANGE DISPLAYED	130 KT	±20 KT			
DIRECTION OF INCREASE		1 to R			
FIXED SCALE?	yes	yes			
SCALE VALUES MARKED?	no	no			
SCALE GRADUATIONS	10 KT	20 KT			
MOVING REFERENCE?	yes	yes			
TYPE OF REFERENCE	horizontal line	vertical line			standby
VALUES IN WHICH FUNCTION IS AVAILABLE	all	all exc. V/STOL, A/A			
DISPLAY CHANGES WITH MODE CHANGES	none	none	none	none	none
NOTES	indications are unreliable in inertial mode		reticle can be manually depressed from 0 to 210 miles below sight line	circles: 50, 100, 150 mil diameter ref. 4.	circles: 5°, 10°, 15° diameter

NUMBER	156	157	158	158(cont.)	159
FUNCTION	DISPLAY TACAN DEVIATION	DISPLAY TACAN DEVIATION	INDICATE TARGET IR-RANGE	INDICATE TARGET IR-RANGE	INDICATE TARGET IR-RANGE
AIR RAFT	P-14	AV-8A	A-7	A-7	P-15
FIGURE NO.	24	35	35	13	36
FORM OF DISPLAY	vertical bar (note)	HDR scale/symbolic	symbolic	symbolic	Letters
LOCATION ON HUD	centered vertically	below center	stop aiming symbol		bottom of 1 edge
DISPLAY LABEL	none	none	none	none	note
RANGE OF VARIABLE	note				
RANGE DISPLAYED	$\pm 6^\circ$	$\pm 7^\circ$			
DIRECTION OF INCREASE		L to R			
FIXED SCALE?	yes	no			
SCALE VALUES MARKED?	no	yes			
SCALE GRADUATIONS		1°			
HOWING REFERENCE?	yes	yes			
TYPE OF REFERENCE	vertical line	horseshoe			
MODES IN WHICH FUNCTION IS AVAILABLE	takeoff/TACAN; cruise/TACAN; land- ing/TACAN	all	attack (guns, rockets)	attack (bombs)	A/A missile
DISPLAY CHARGES WITH MODE CHANGES	none	none	none	none	none
NOTES	bar limits at edge of display nearest radial. bar is solid for "to", dotted for "from"	diagonal line through horseshoe indicates limiting	appears at slant range of 8192 FT (guns) or 14366 FT (rockets)	see 158, 159 solution cues ap- pear when target is in range	"IR RNC" ref. 6

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NUMBER	160			161		162		163		163(cont)	
	INDICATE TARGET IN-RANGE	INDICATE TARGET OUT OF RANGE	INDICATE TARGET RANGE	INDICATE TARGET RANGE	INDICATE TARGET RANGE	INDICATE TARGET RANGE	INDICATE TARGET RANGE	INDICATE TARGET RANGE	INDICATE TARGET RANGE	INDICATE TARGET RANGE	INDICATE TARGET RANGE
AIRCRAFT	MIL-D-81641(AS)	P-14	P-5	P-5	P-5	P-5	P-5	P-14	P-14	P-14	P-14
FIGURE NO.	43	8						54		55	
TURN OF DISPLAY	symbolic	symbolic						vertical scale		vertical scale	
LOCATION ON HUD								note		left side	
DISPLAY LABEL	none	none	none	none	none	none	none	none		none	
NAME OF VARIABLE											
RANGE DISPLAYED								note		note	
DIRECTION OF INCREASE								up		up	
FIXED SCALE?								yes		yes	
SCALE VALUES MARKED?								yes		yes	
SCALE GRADUATIONS								note			
MOVING REFERENCE?								yes		yes	
TYPE OF REFERENCE								note		note	
MODES IN WHICH FUNCTION IS AVAILABLE	guided weapons	A/A manual gun; A/A Sidewinder						A/A optical track; A/A Sidewinder; boresight; A/A Sidewinder normal; A/A Sparrow normal; A/A Phoenix normal			
DISPLAY CHANGES WITH MODE CHANGES	none	none	none	none	none	none	none	none		none	
NOTES	see no. 127 tail appears on symbol when in range	symbol disappears when target in range	diamond shaped marker indicates in-range; round marker indicates minimum range					ref. 3 text says scale is on left edge of HUD, il- lustrations show scale on right edge. range selectable: 5, 10, 20, 50, 100, 200 NM. gradua- tions depend on RMC carets; MAX and MIN RMC, by HDR lines		range selectable; options not speci- fied. range indicated by caret. MAX and MIN ranges indica- ted by horizontal lines. see no. 76 ref. 4	

ITEM	163(cont)	164	165	166	167
FUNCTION	DISPLAY TARGET RANGE	DISPLAY TARGET RANGE	DISPLAY TARGET RANGE	DISPLAY TARGET RANGE	DISPLAY TARGET RANGE
AIRCRAFT	F-14	F-15	RL-8-81641(AS)	RL-8-81641(AS)	RL-8-81641(AS)
FIGURE NO.	36	36	57	36	36
FORM OF DISPLAY	symbolic	vertical scale	horizontal scale	symbolic	symbolic
LOCATION ON HUD		right side	bottom edge		
DISPLAY LABEL	none	none	none	none	none
RANGE OF VARIABLE	0 to 4000 FT				
RANGE DISPLAYED	0 to 4000 FT	note	note		
DIRECTION OF INCREASE	clockwise	up	1 to 2		
FIXED SCALE?		yes	yes		
SCALE VALUES MARKED?	no	yes	yes		
SCALE GRADUATIONS	1000 FT		note		
HAVING REFERENCE?		yes	yes		
TYPE OF REFERENCE	note	note	note		
MODES IN WHICH FUNCTION IS AVAILABLE	A/A optical track	A/A	bore-sight weapons; guided weapons	terrain following	A/A
DISPLAY CHANGES WITH HUD CHANGES	none	display shifts with gear extension	range scale change- as	none	none
NOTES	sides of a diamond disappear one at a time with decreasing range	range selectable. target range indicated by caret. 2 MAX and 1 MIN ranges indicated by horizontal lines. see no. 77	symbology appears at lock-on. display range for bore-sight shall be 10000 FT. increments -1000 FT. ranges for guided weapons in MM, with 1 MM increments. range indicated by vertical line. MAX and MIN ranges indicated by carets	horizontal lines represent elevation angles to highest terrain within each of 5 range increments	

NAME FUNCTION	168	169	170	171	172
	DISPLAY TIME-TO-GO TO WEAPON RELEASE	DISPLAY TIME-TO-GO TO WEAPON RELEASE	DISPLAY DEF HOMER	DISPLAY VELOCITY VECTOR	DISPLAY VELOCITY VECTOR
AIR DATA	F-14	F-111A	AV-8A	A-7	F-14
FIGURE NO.	10	15	39	9	9
FORM OF DISPLAY	circular scale	circular scale	HOR scale, symbolic	symbolic	symbolic
LOCATION ON HUD			below center		
DISPLAY LABEL	none	none	none	none	none
RANGE OF VARIABLE	15 seconds				
RANGE DISPLAYED	15 seconds	note	51°		
DIRECTION OF INCREASE	clockwise	clockwise	L to R		
FIXED SCALE?	yes	yes	no		
SCALE VALUES MARKED?	no	no	yes		
SCALE GRADUATIONS	5 seconds	note	5°		
FIXED REFERENCE?	yes	yes	yes		
TYPE OF REFERENCE	bar	bar	horseshoe		
PAGES IN WHICH FUNCTION IS AVAILABLE	A/G manual	command; DIV; LADD	all	all	A/G computer; land- ing/vector
DISPLAY CHANGES WITH MODE CHANGES	none	none	none	none	none
NOTES	ref. 4 AWC-14	time scale selecta- ble. full scale 300 seconds has 100 second-graduations; 30 second scale has 10 second gradua- tions.	after APC 105		

NUMBER	173	174	175	176	177
FUNCTION	DISPLAY VELOCITY VECTOR	DISPLAY VELOCITY VECTOR	DISPLAY VELOCITY VECTOR	COMMAND VELOCITY SPEED	COMMAND VELOCITY SPEED
AIRCRAFT	F-15	MIL-D-81641(AS)	MIL-STD-884B	MIL-D-81641(AS)	MIL-STD-884B
FIGURE NO.	9	45	45	5	3
FORM OF DISPLAY	symbolic	symbolic	symbolic	vertical scale left edge	vertical scale left edge
LOCATION ON HUD	none	none	none	V	V
DISPLAY LABEL	none	none	none	vertical scale left edge	vertical scale left edge
RANGE OF VARIABLE	none	none	none	vertical scale left edge	vertical scale left edge
RANGE DISPLAYED	none	none	none	vertical scale left edge	vertical scale left edge
DIRECTION OF INCREASE	none	none	none	vertical scale left edge	vertical scale left edge
FIXED SCALE?	none	none	none	vertical scale left edge	vertical scale left edge
SCALE VALUES MARKED?	none	none	none	vertical scale left edge	vertical scale left edge
SCALE GRADUATIONS	none	none	none	vertical scale left edge	vertical scale left edge
MOVING REFERENCE?	none	none	none	vertical scale left edge	vertical scale left edge
TYPE OF REFERENCE	none	none	none	vertical scale left edge	vertical scale left edge
MODES IN WHICH FUNCTION IS AVAILABLE	all	all exc. boresight	all	all exc. boresight	all exc. boresight
DISPLAY CHANGES WITH MODE CHANGES	none	none	none	all exc. boresight	all exc. boresight
NOTES	none	none	none	none	none



NUMBER	178	179	179 (cont)	180	181
FUNCTION	DISPLAY VERTICAL SPEED	DISPLAY VERTICAL SPEED	DISPLAY VERTICAL SPEED	DISPLAY VERTICAL SPEED	DISPLAY VERTICAL SPEED
AIR TRAFF	A-7	F-14	F-14	CL-34	AV-8A
FIGURE NO.	2	3C	16	1	19
FORM OF DISPLAY	vertical scale	vertical scale	vertical scale	vertical scale	vertical scale
LOCATION ON HUD	right edge	left edge	right edge	right edge	right edge
DISPLAY LABEL	none	none	none	none	none
RANGE OF VARIABLE	±1000 FT/MIN	±1500 FT/MIN	±1000 FT/MIN		2000 to -3000 FT/MIN
RANGE DISPLAYED	±1000 FT/MIN	±1500 FT/MIN	±1000 FT/MIN		1000 to -2000 FT/MIN
DIRECTION OF INCREASE	up	up	up	up	up
FIXED SCALE?	yes	yes	yes	yes	yes
SCALE VALUES MARKED?	no	yes	no	no	no
SCALE GRADUATIONS	200 FT/MIN	500 FT/MIN	200 FT/MIN		500 FT/MIN
MOVING REFERENCE?	yes	yes	yes	yes	yes
TYPE OF REFERENCE:	triangle	caret	V with sidebar	arrowhead	"thermo" with caret
PHASES IN WHICH FUNCTION IS AVAILABLE	landing; Data Link	takeoff; landing		approach; transi- tion	V/STOL; NAV; GEN
DISPLAY CHANGES WITH MODE CHANGES	none	none	none	none	none
NOTES			ref. 4		

NUMBER	182		183		184		185		186	
	DISPLAY VERTICAL SPEED	DISPLAY VERTICAL SPEED	DISPLAY VERTICAL SPEED	DISPLAY VERTICAL SPEED	DISPLAY VERTICAL SPEED	DISPLAY VERTICAL SPEED	DISPLAY VERTICAL SPEED	DISPLAY VERTICAL SPEED	DISPLAY VERTICAL SPEED	DISPLAY VERTICAL SPEED
AIRCRAFT	MIL-D-81641(AS)	MIL-D-81641(AS)	MIL-D-81641(AS)	MIL-D-81641(AS)	MIL-D-81641(AS)	MIL-D-81641(AS)	MIL-D-81641(AS)	MIL-D-81641(AS)	MIL-D-81641(AS)	MIL-D-81641(AS)
FIGURE NO.	5	5	5	5	5	5	5	5	5	5
POSS OF DISPLAY	vertical scale	vertical scale	vertical scale	vertical scale	vertical scale	vertical scale	vertical scale	vertical scale	vertical scale	vertical scale
LOCATION ON HUD	left edge	left edge	left edge	left edge	left edge	left edge	left edge	left edge	left edge	left edge
DISPLAY LABEL	V	V	V	V	V	V	V	V	V	V
RANGE OF VARIABLE	1100-00 FT/MIN	1100-00 FT/MIN	1100-00 FT/MIN	1100-00 FT/MIN	1100-00 FT/MIN	1100-00 FT/MIN	1100-00 FT/MIN	1100-00 FT/MIN	1100-00 FT/MIN	1100-00 FT/MIN
RANGE DISPLAYED	1000 FT/MIN	1000 FT/MIN	1000 FT/MIN	1000 FT/MIN	1000 FT/MIN	1000 FT/MIN	1000 FT/MIN	1000 FT/MIN	1000 FT/MIN	1000 FT/MIN
DIRECTION OF INCREASE										
FIXED SCALE?	no	no	no	no	no	no	no	no	no	no
SCALE VALUES MARKED?	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
SCALE GRADUATIONS	100 FT/MIN	100 FT/MIN	100 FT/MIN	100 FT/MIN	100 FT/MIN	100 FT/MIN	100 FT/MIN	100 FT/MIN	100 FT/MIN	100 FT/MIN
MOVING REFERENCE?	no	no	no	no	no	no	no	no	no	no
TYPE OF REFERENCE	horizontal line	horizontal line	horizontal line	horizontal line	horizontal line	horizontal line	horizontal line	horizontal line	horizontal line	horizontal line
MODES IN WHICH FUNCTION IS AVAILABLE	all exc. bore-sight	all exc. bore-sight	all exc. bore-sight	all exc. bore-sight	all exc. bore-sight	all exc. bore-sight	all exc. bore-sight	all exc. bore-sight	all exc. bore-sight	all exc. bore-sight
DISPLAY CHANGES WITH MODE CHANGES	none	none	none	none	none	none	none	none	none	none
NOTES										

NUMBER	187	188	189	190	191
FUNCTION	INDICATE PRESENCE OF WARNING SIGNAL	INDICATE PRESENCE OF WARNING SIGNAL	INDICATE PRESENCE OF WARNING SIGNAL	INDICATE PRESENCE OF WARNING SIGNAL	INDICATE WEAPON RELEASE
AIRCRAFT	F-14	F-15	HL-D-81641(AS)	HL-STD-884B	HL-D-81641(AS)
FIGURE NO.	61		61	61	45
FORM OF DISPLAY	symbolic	letters	symbolic	SYM/letters (note)	symbolic
LOCATION ON HUD	below center	note	below center	note	
DISPLAY LABEL	none	note	none	note	none
RANGE OF VARIABLE					
RANGE DISPLAYED					
DIRECTION OF INCREASE					
FIXED SCALE?					
SCALE VALUES MARKED?					
SCALE GRADUATIONS					
POINTING REFERENCE?					
TYPE OF REFERENCE					
MODES IN WHICH FUNCTION IS AVAILABLE	all	all	all exc. bore-sight	all	bombing
DISPLAY CHANGES WITH MODE CHANGES	none	none	none	none	none
NOTES	flashes	word "warning" ap- pears alternately above and below center of display	flashes 4 times/sec	either large flash- ing W in center of of display or flashing word "NAECS" in lower left corner	velocity vector symbol flashes for 3 seconds after weapon release at 4 times/sec

MIRAGE	192	193
FUNCTION	DISPLAY WING INCIDENCE	DISPLAY WING SWEEP
ATA LAF?	CL-84	P-14
FIGURE NO.	1	
FORM OF DISPLAY	vertical scale	digital
LOCATION ON HUD	right edge	lower right
DISPLAY LABEL	none	none
RANGE OF VARIABLE		20° to 68°
LARGE DISPLAYED		20° to 68°
DIRECTION OF INCREASE		
FIXED SCALE?	yes	
SCALE VALUES MARKED?	no	
SCALE GRADUATIONS	1°	
MOVING REFERENCE?	yes	
TYPE OF REFERENCE	rectangle	
HANDS IN WHICH FUNCTION IS AVAILABLE	approach	
DISPLAY CHANGES WITH HIDE CHANGES	none	none
NOTES		see no. 87 ref. 4

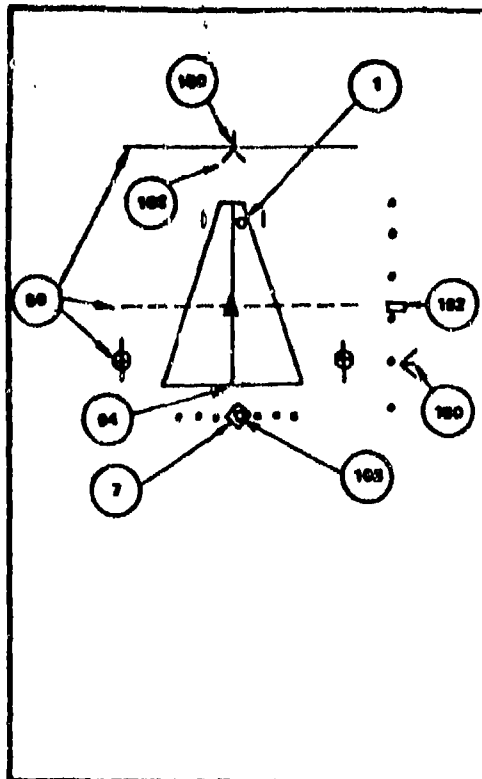


FIG. 1

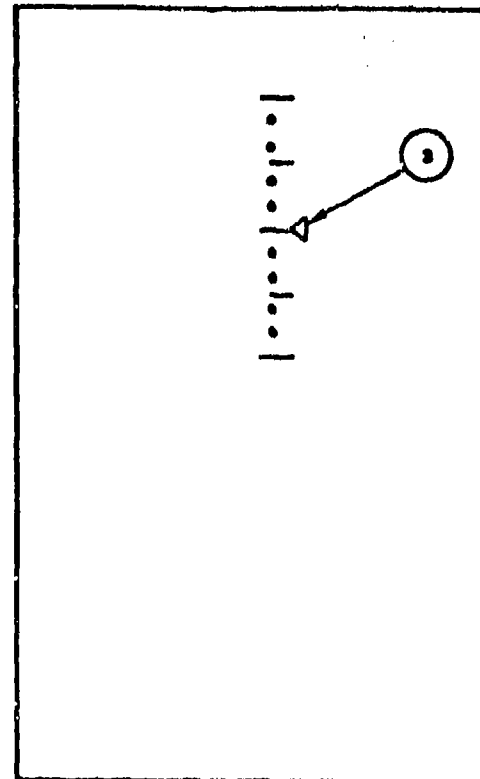


FIG. 2

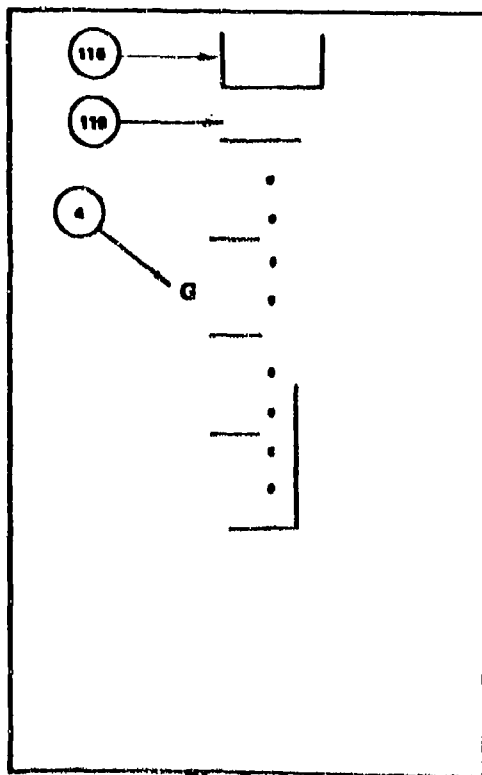


FIG. 3

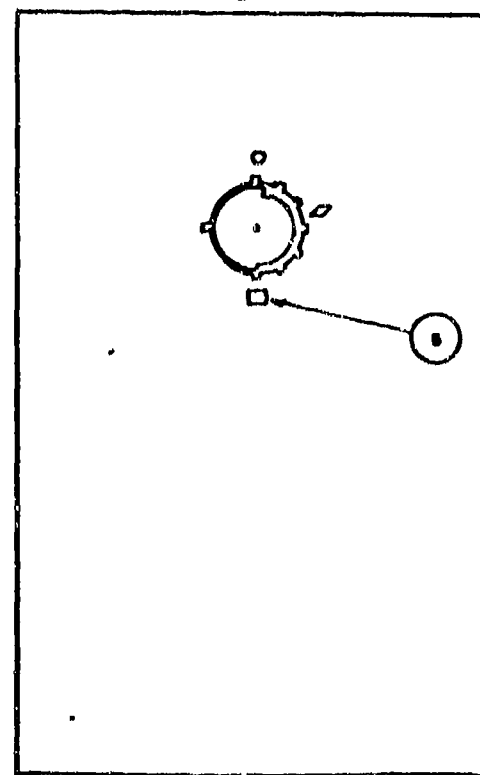


FIG. 4

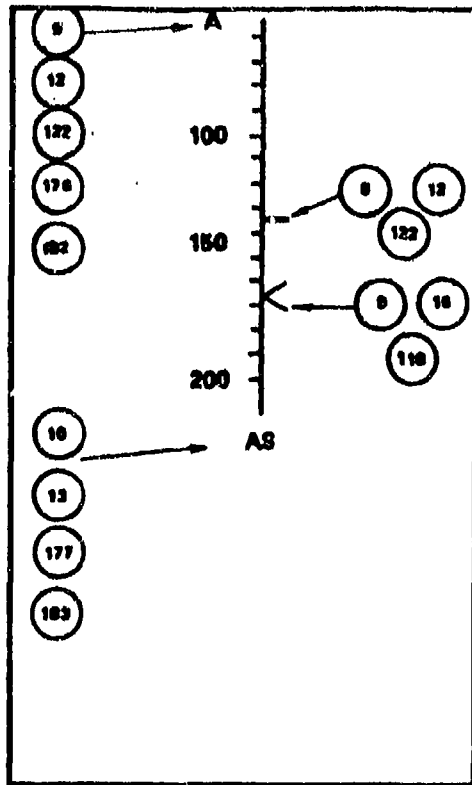


Fig. 5

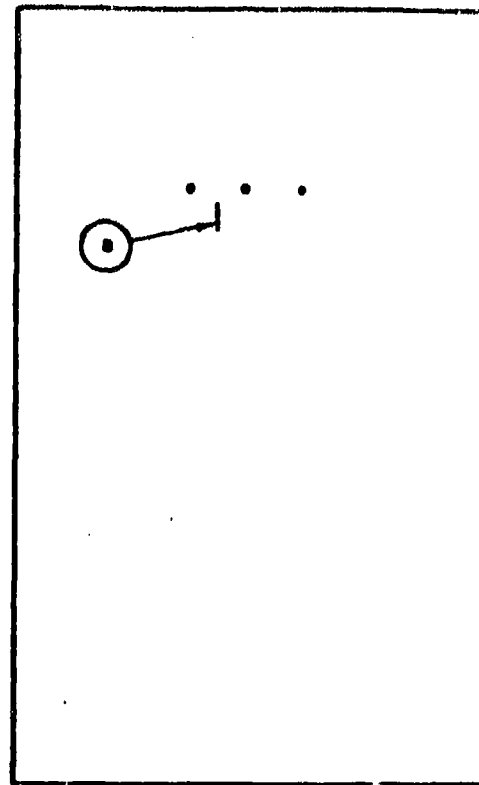


Fig. 6

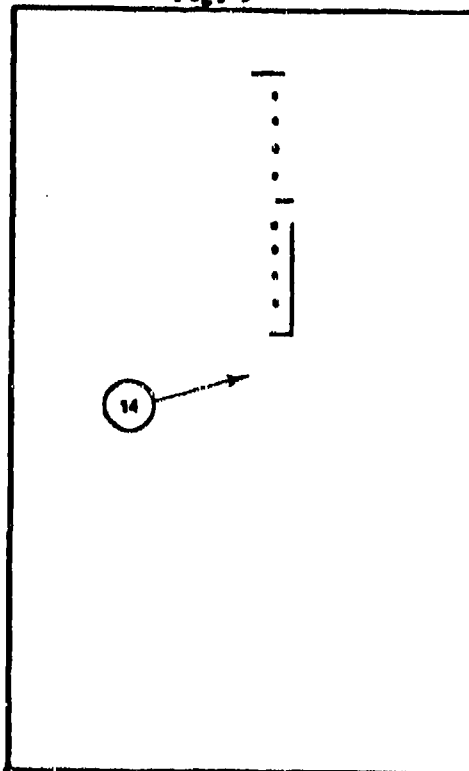


Fig. 7

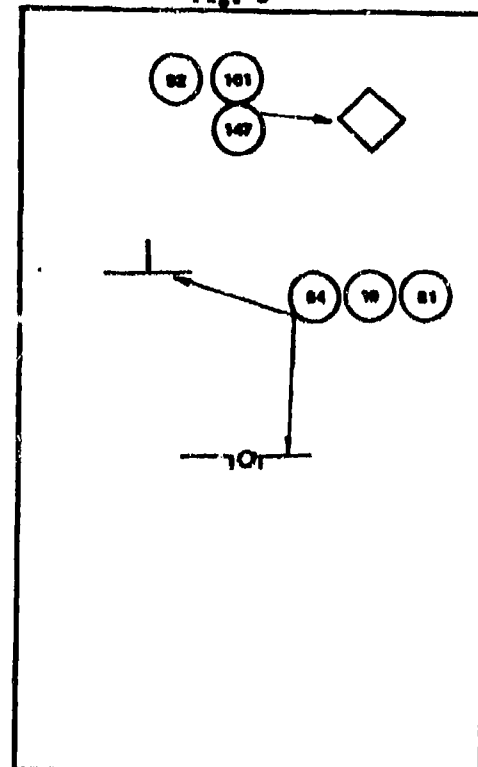


Fig. 8

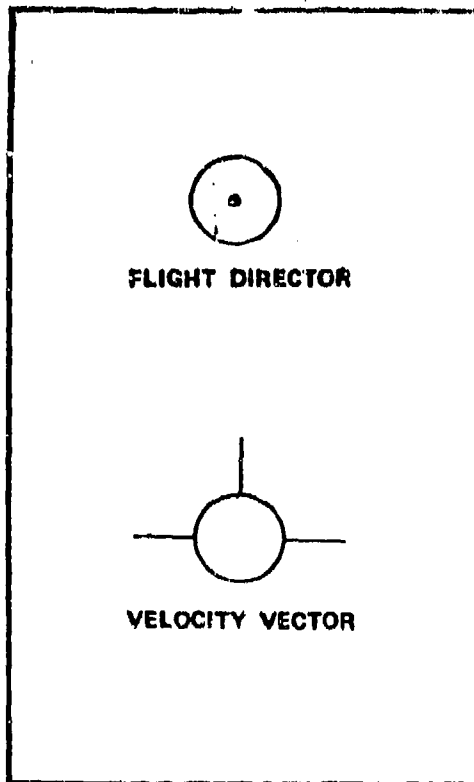


Fig. 9

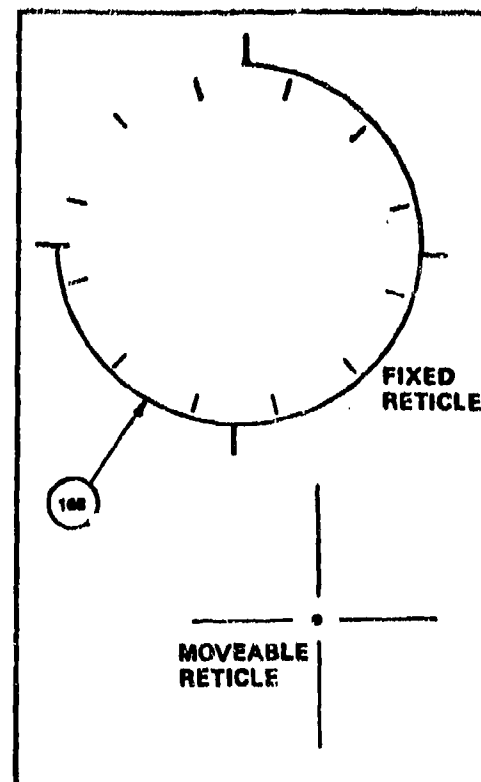


Fig. 10

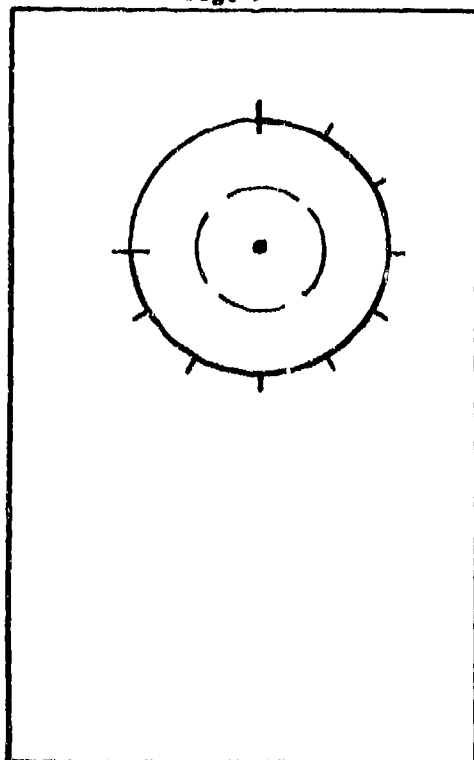


Fig. 11

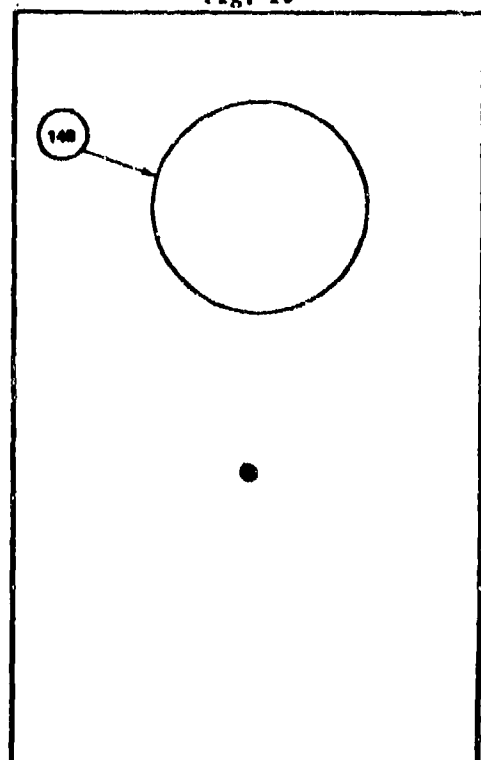
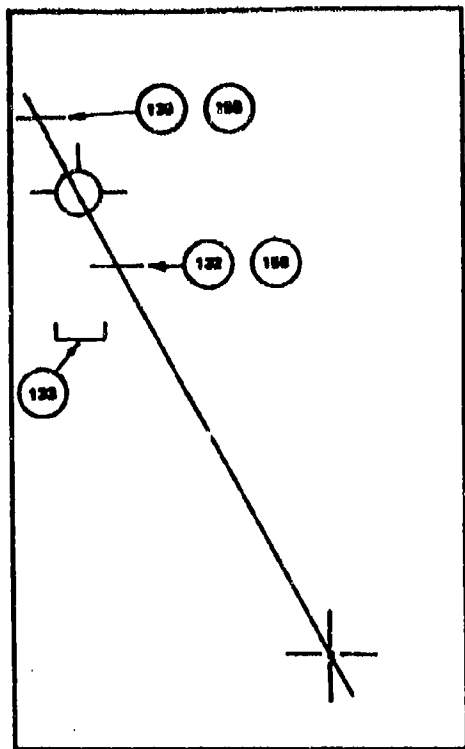
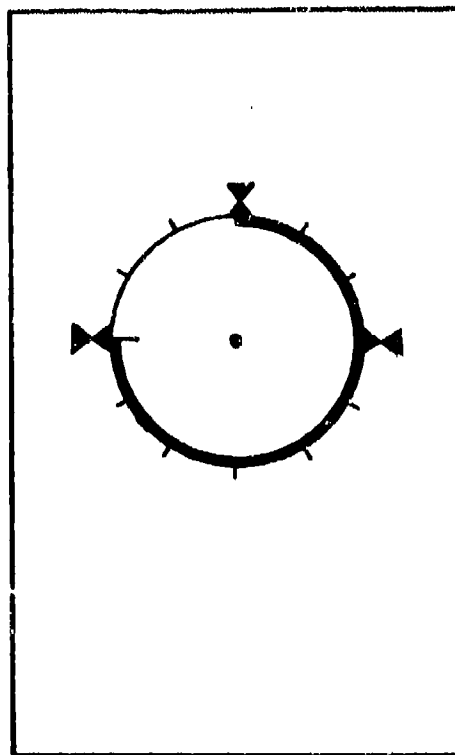


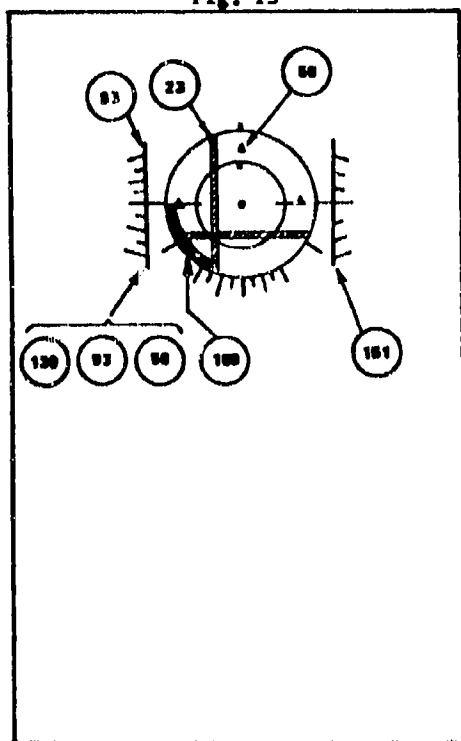
Fig. 12



**Fig. 13**



**Fig. 14**



**Fig. 15**

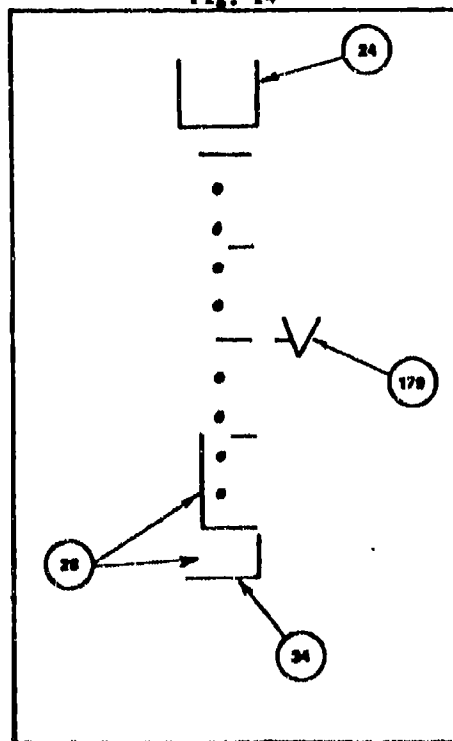


Fig. 16



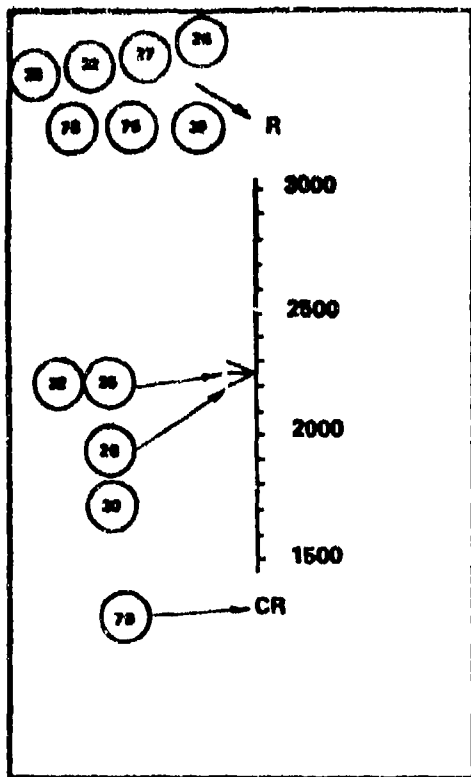


Fig. 17

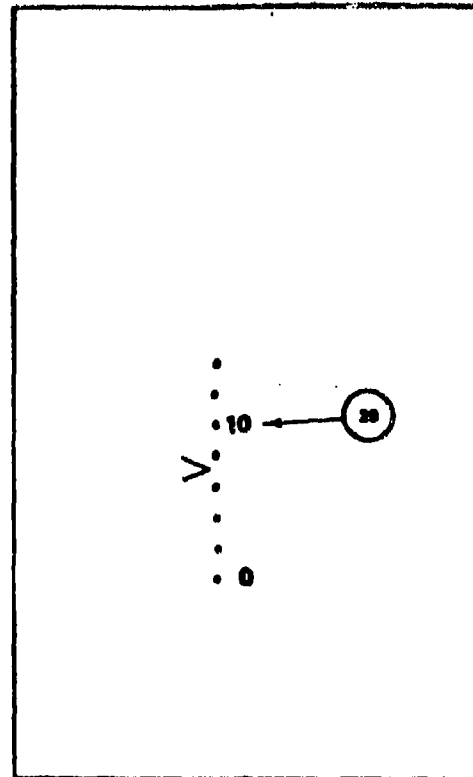


Fig. 18

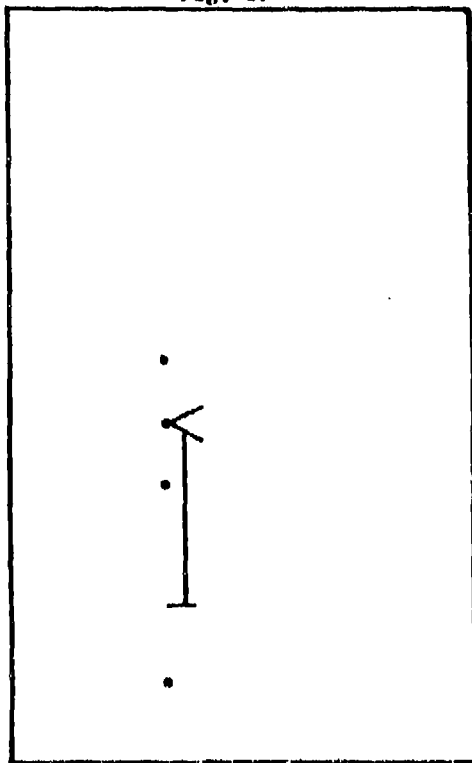


Fig. 19

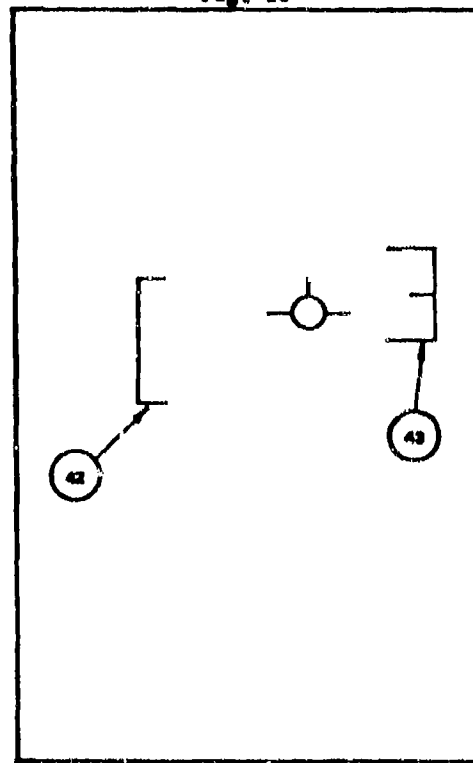


Fig. 20

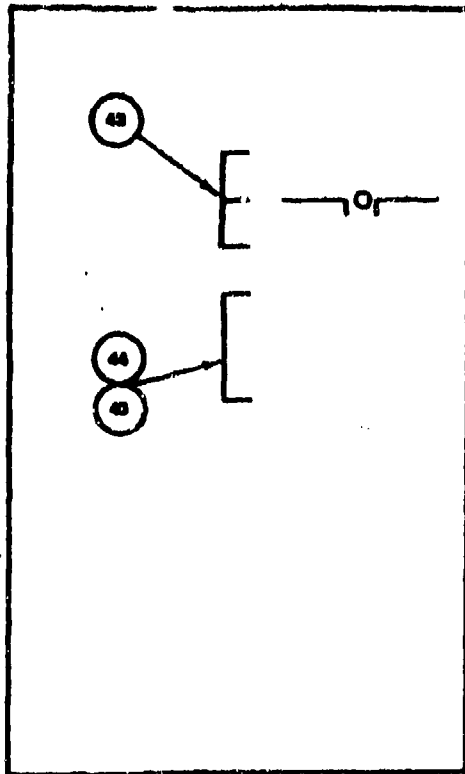


Fig. 21

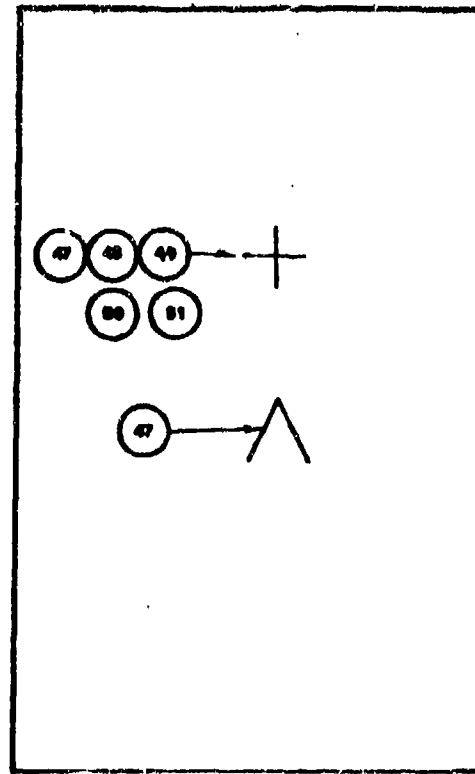


Fig. 22

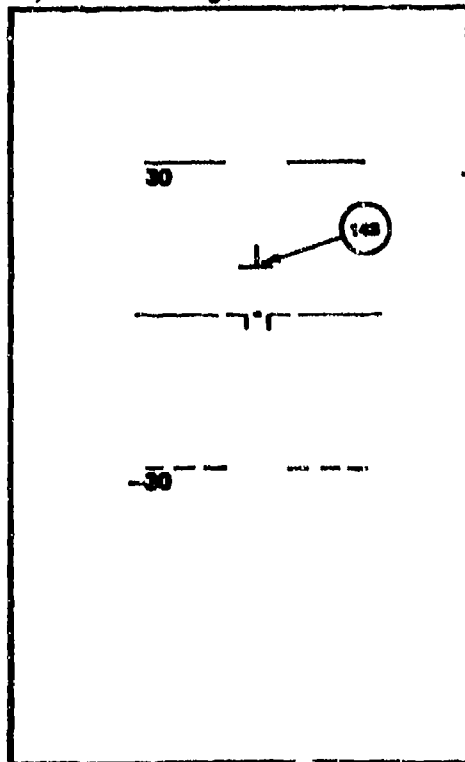


Fig. 23

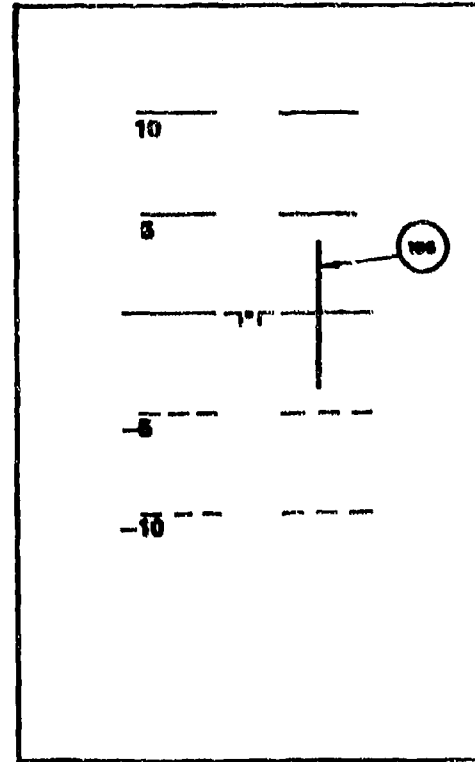
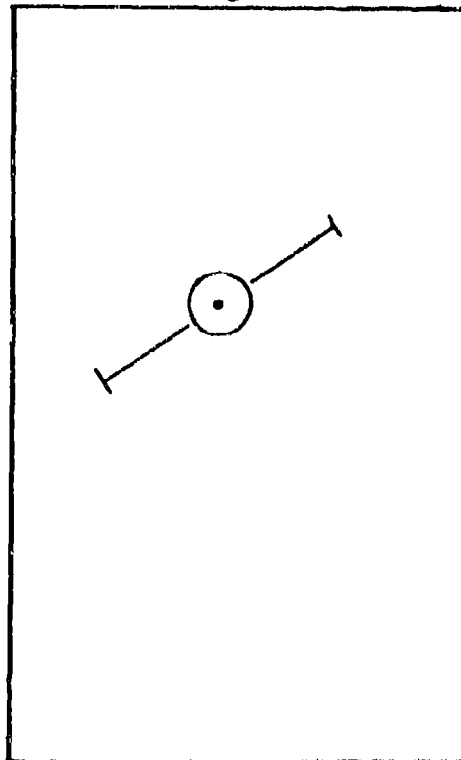
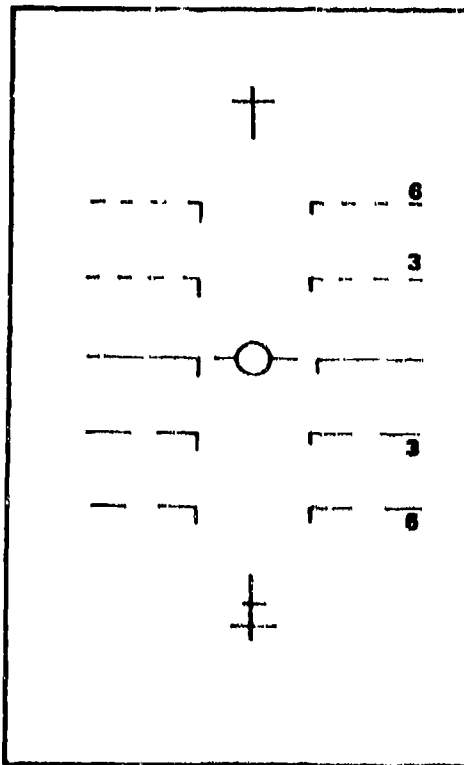
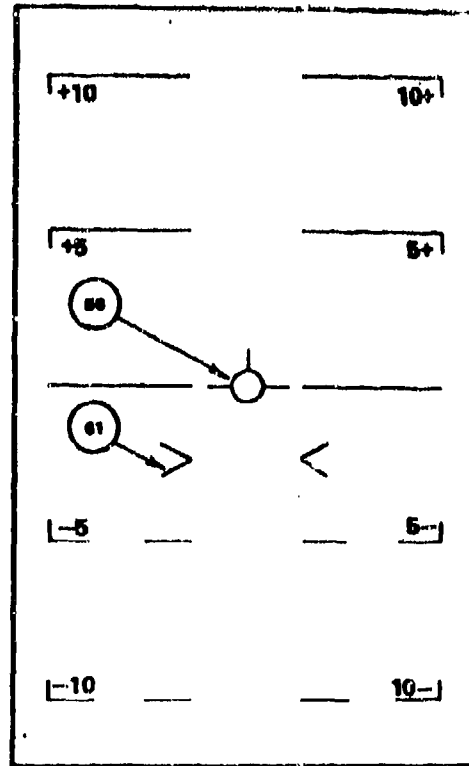
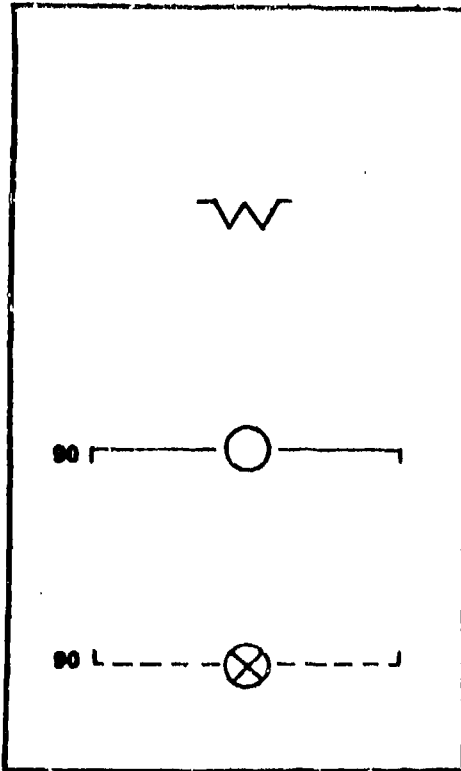


Fig. 24



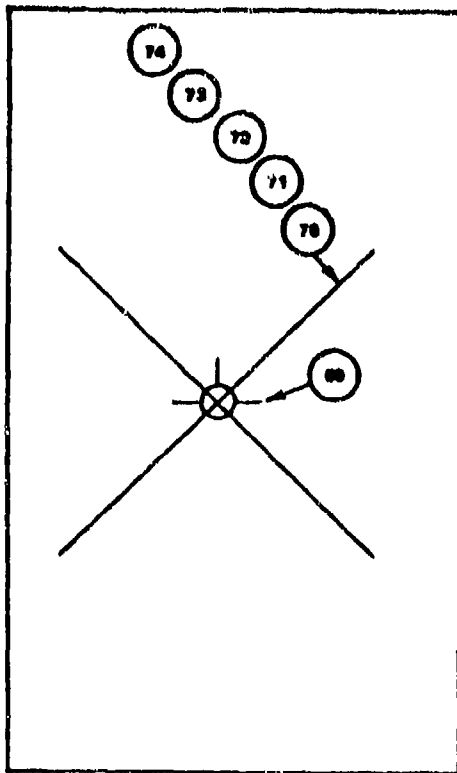


Fig. 29

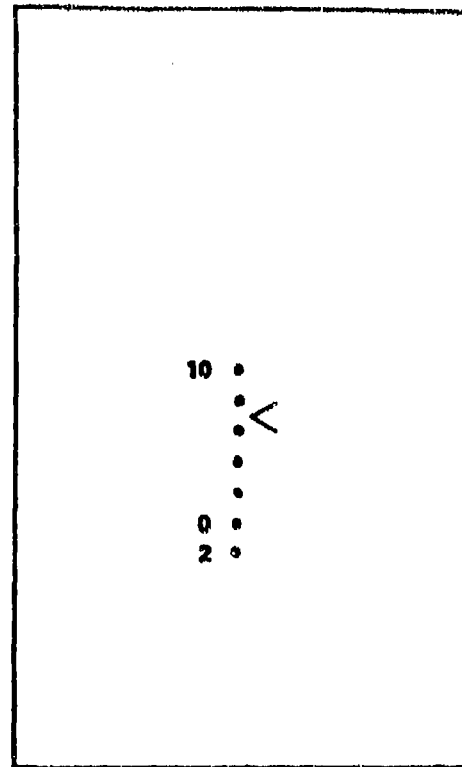


Fig. 30

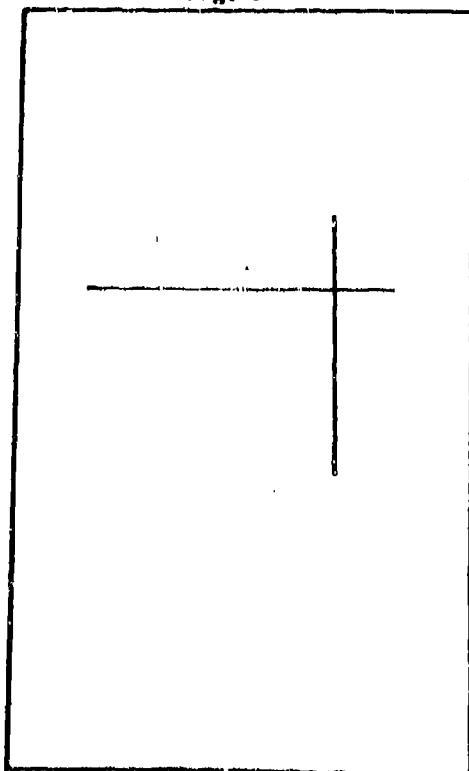


Fig. 31

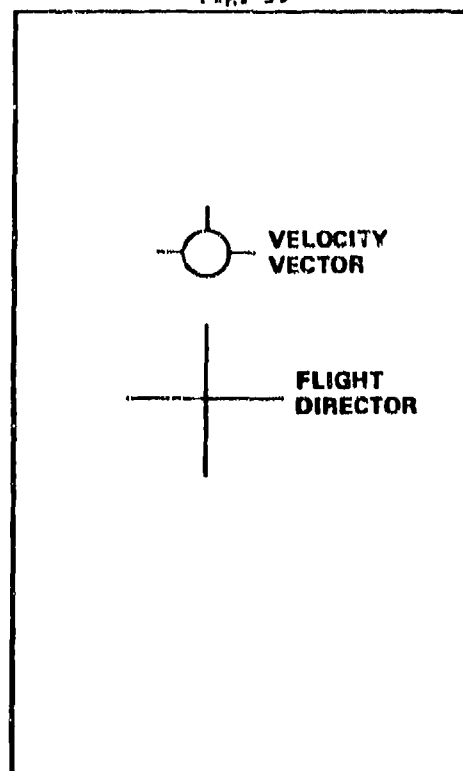


Fig. 32

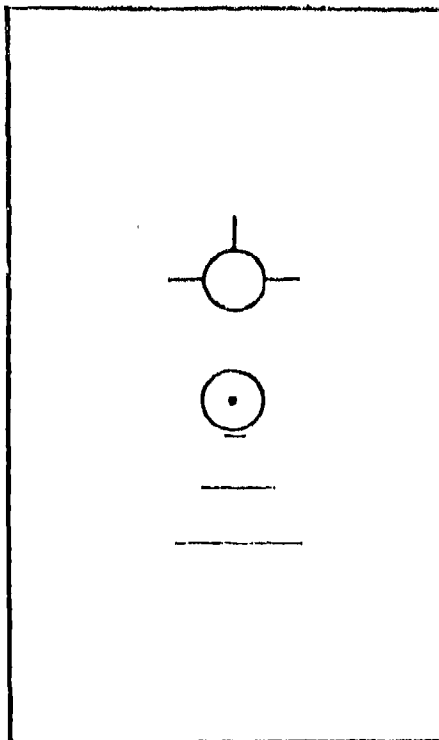


Fig. 33

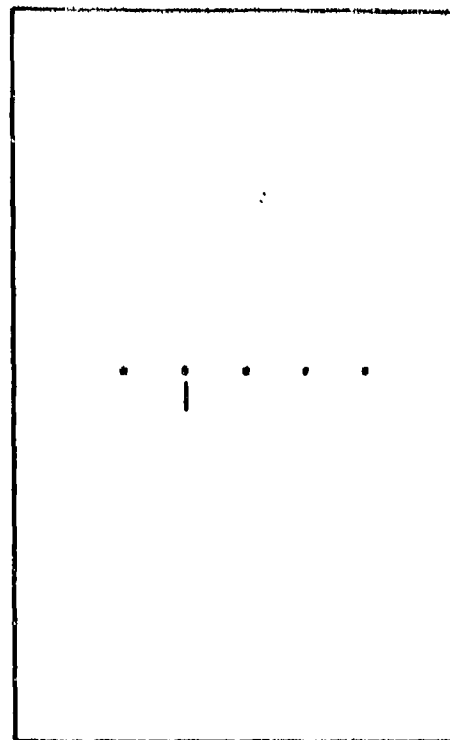


Fig. 34

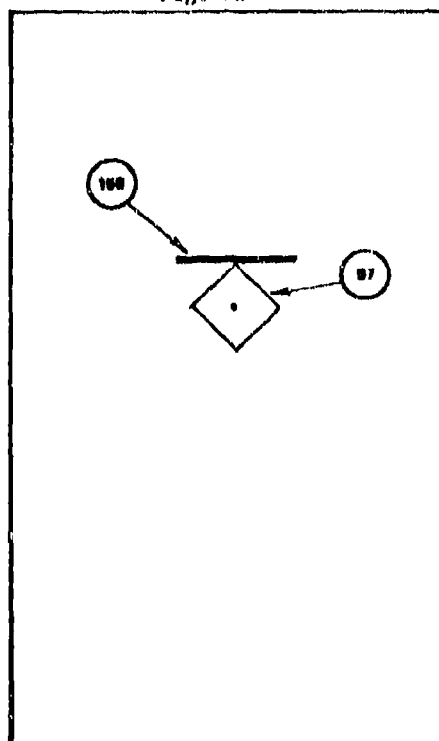


Fig. 35

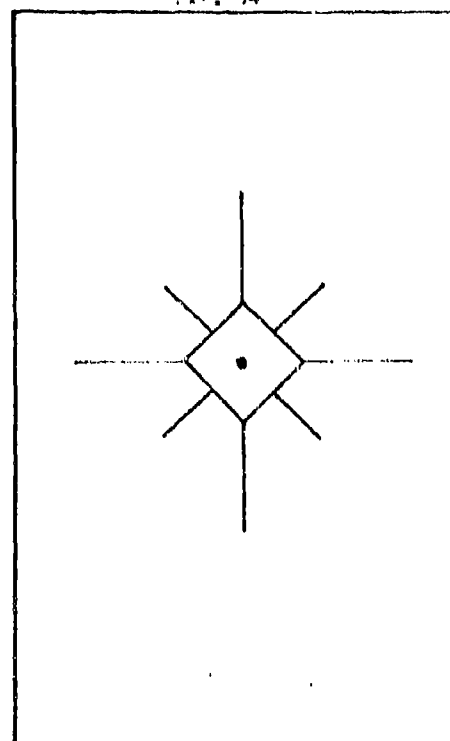


Fig. 36

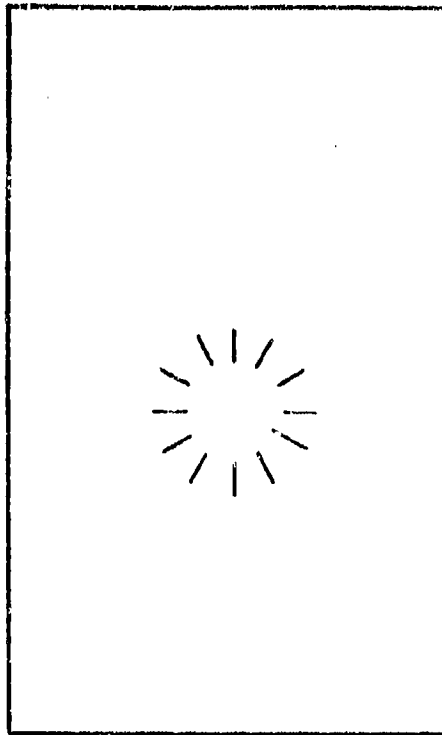


Fig. 37

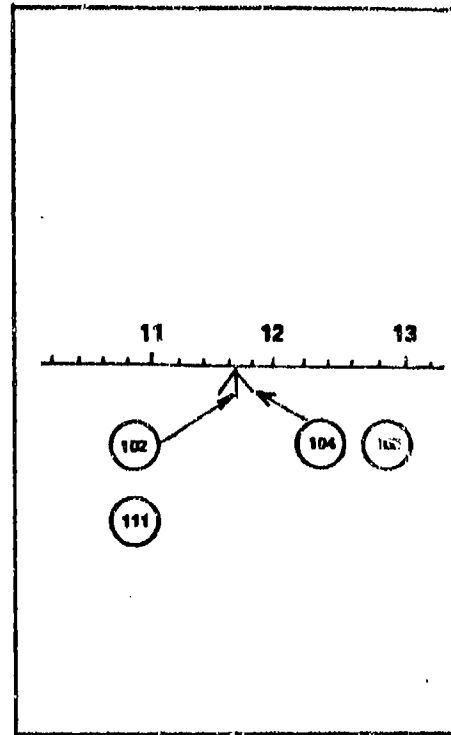


Fig. 38

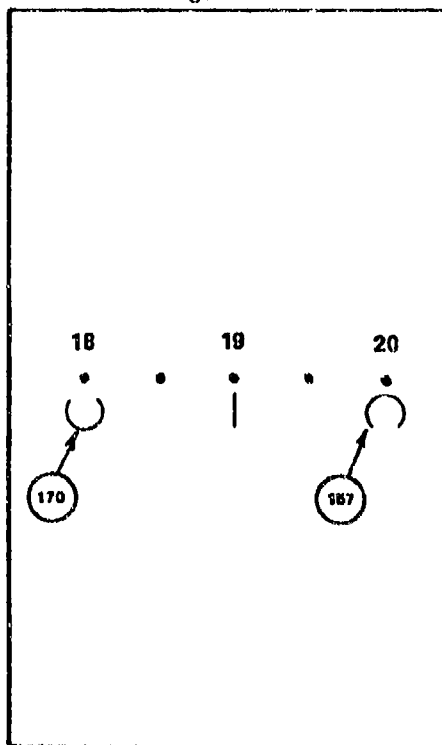


Fig. 39

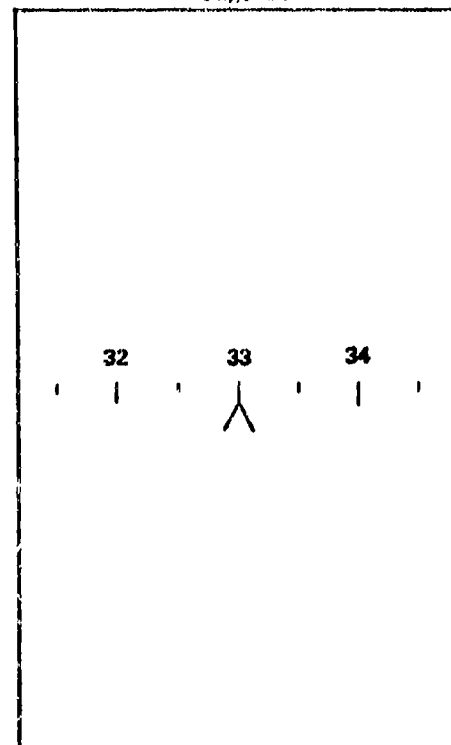


Fig. 40

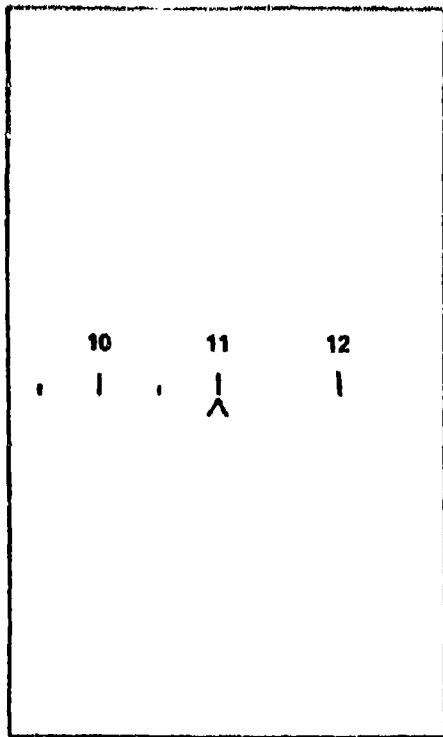


Fig. 41

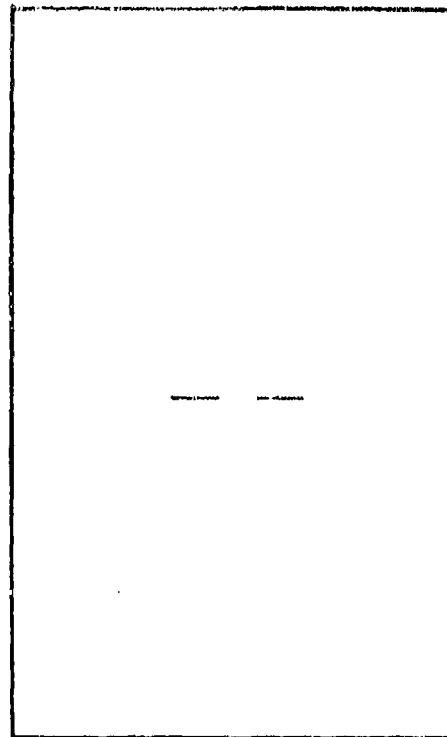


Fig. 42

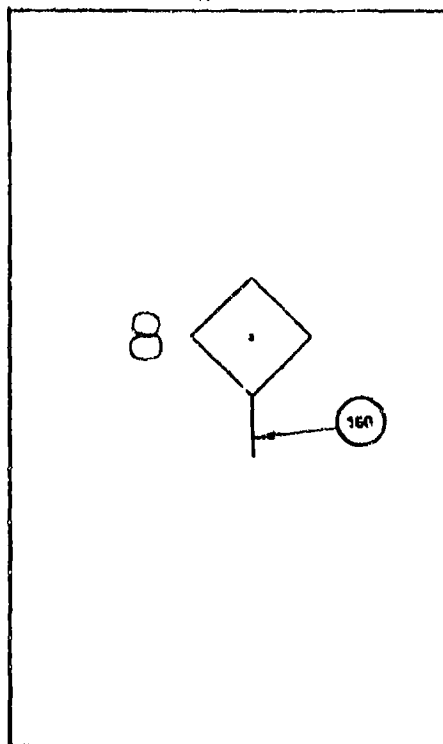


Fig. 43

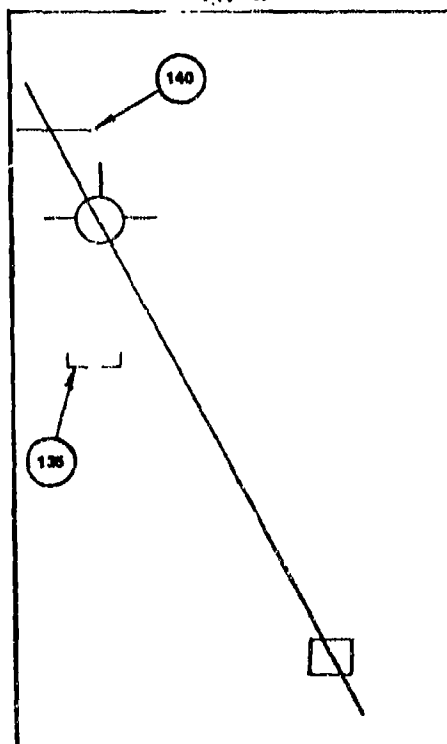


Fig. 44

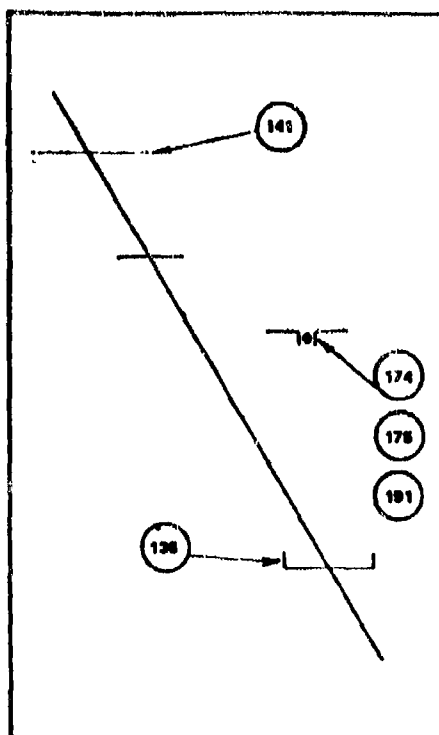


Fig. 45

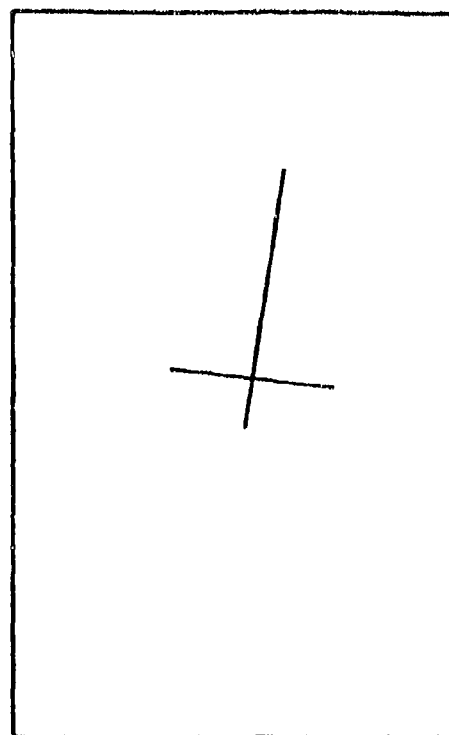


Fig. 46

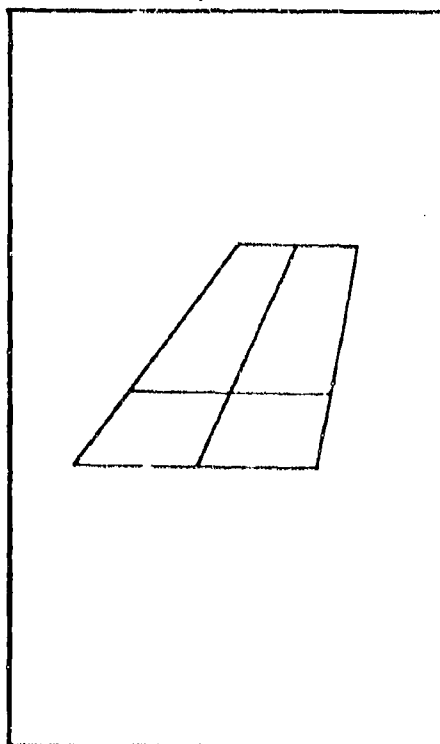


Fig. 47

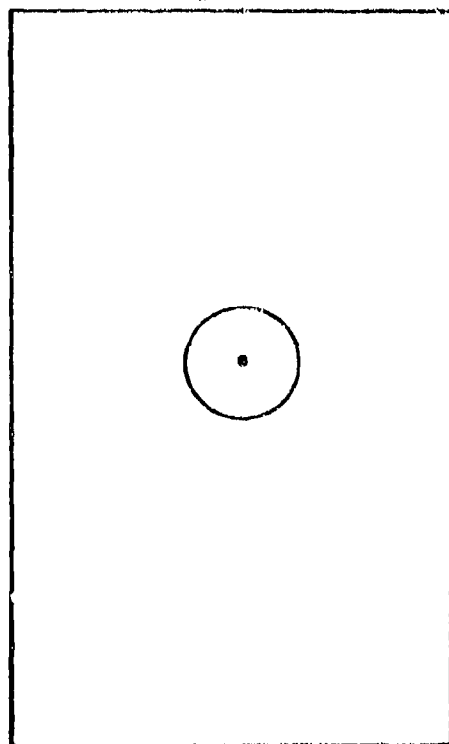


Fig. 48



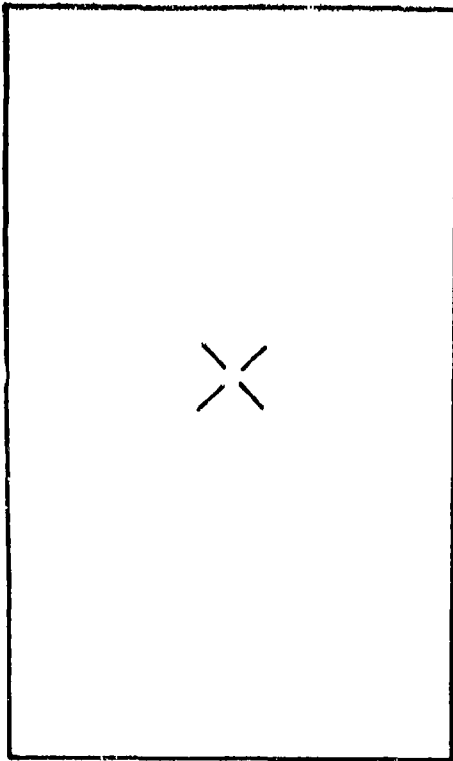


Fig. 49

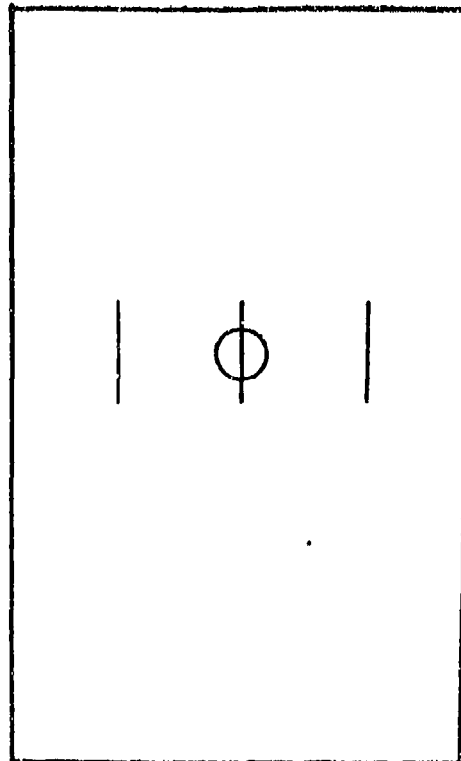


Fig. 50

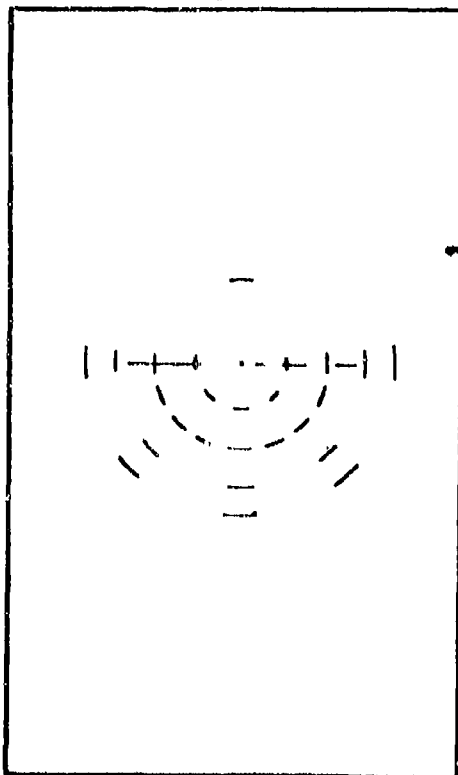


Fig. 51

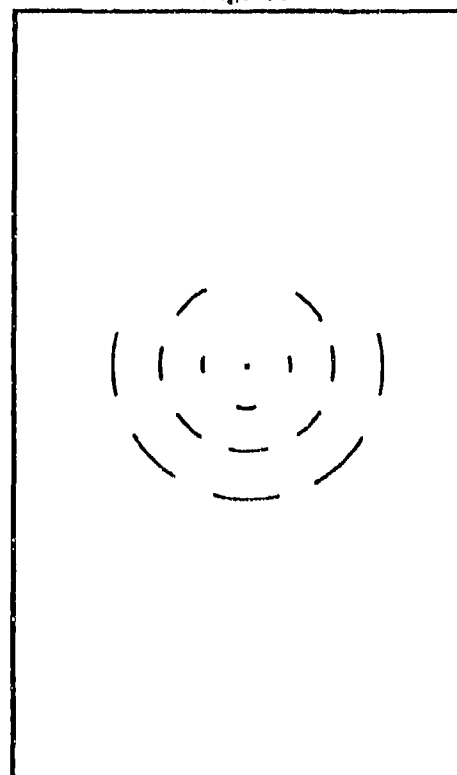


Fig. 52

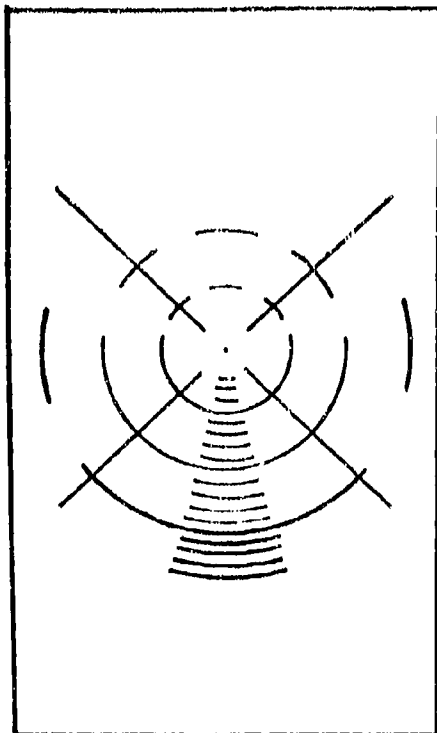


Fig. 53

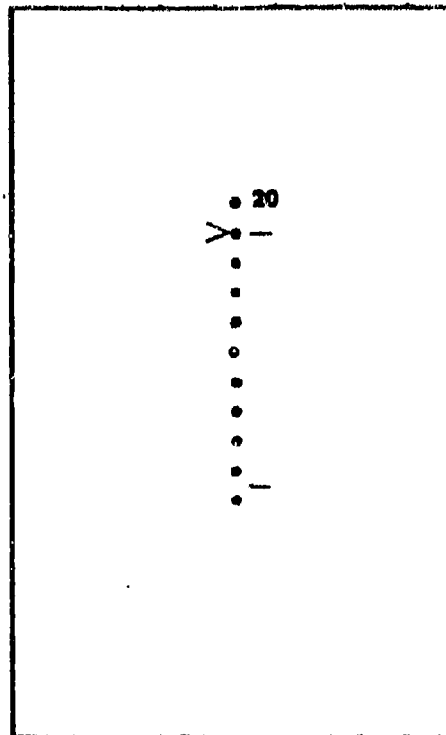


Fig. 54

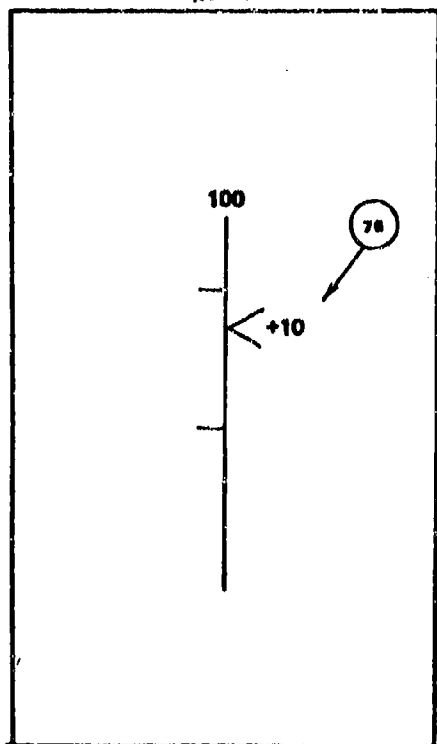


Fig. 55

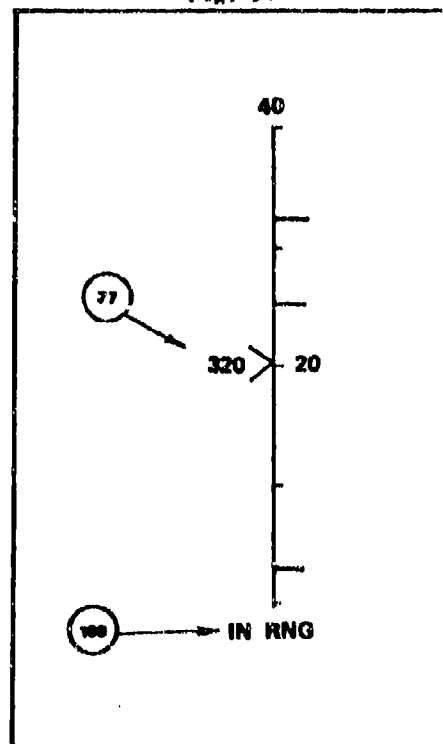


Fig. 56

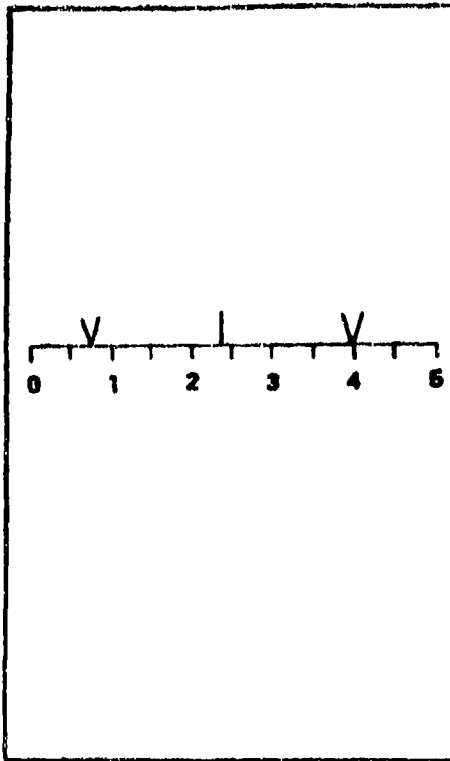


Fig. 57

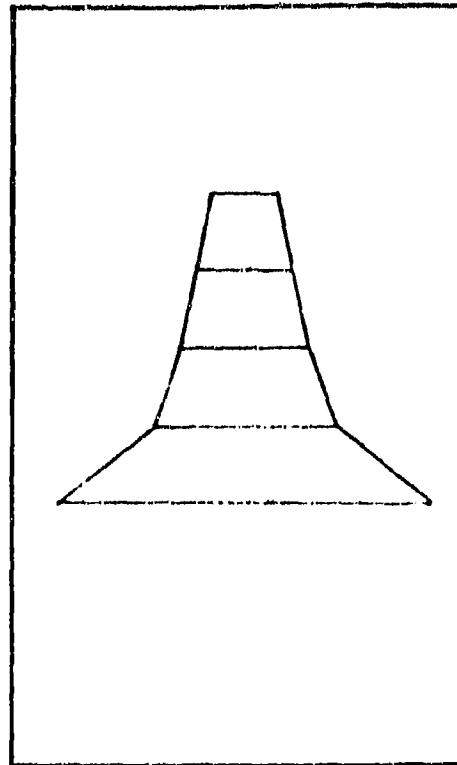


Fig. 58

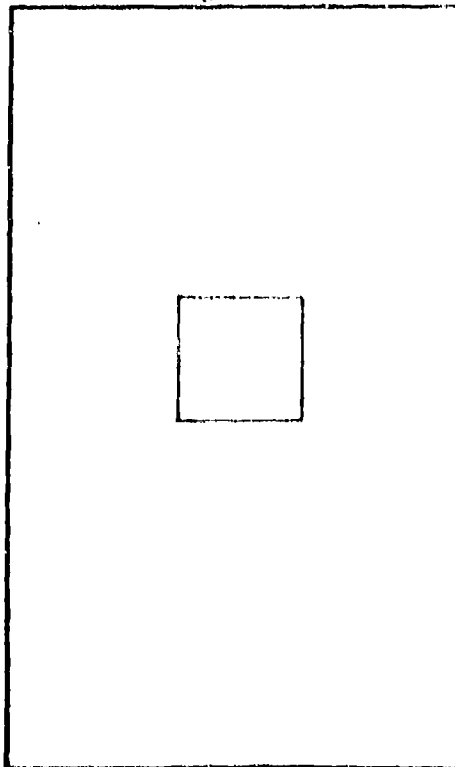


Fig. 59

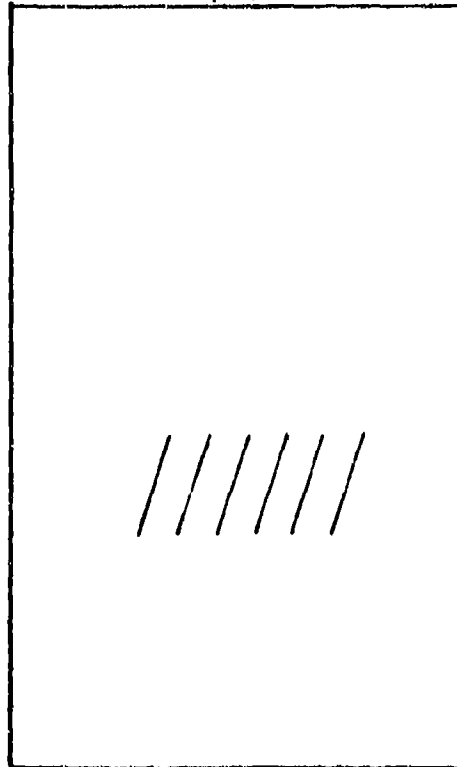


Fig. 60

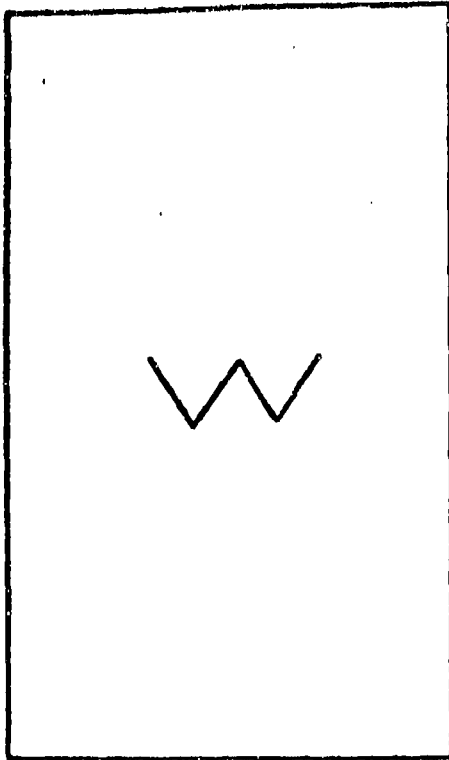


Fig. 51

## M O D E S

A-7

En Route Navigation  
 Terrain Following  
 Landing  
 Data Link  
 Normal Attack Bomb  
 Normal Attack Offset Bomb  
 Radar Bomb  
 Radar Bomb Offset Bomb  
 Navigation Bomb  
 Gun  
 Rocket

F-5

Guns  
 Missile  
 Manual

F-14

Takeoff/Manual  
 Takeoff/TACAN  
 Cruise/Vector  
 Cruise/TACAN  
 Cruise/Manual  
 Cruise/Destination  
 A/A Manual Gun  
 A/A Optical Track  
 A/A Sidewinder Boresight  
 A/A Sidewinder Normal  
 A/A Phoenix Boresight  
 A/A Phoenix Normal  
 A/A Sparrow Boresight  
 A/A Sparrow Normal  
 A/G Computer-Initial Point  
 A/G Computer-Target  
 A/G Precision Course Direction  
 A/G Computer-Pilot (Bomb)  
 A/G Computer-Pilot (Guns, Rockets)  
 A/G Manual  
 Landing/Vector  
 Landing/All Weather Landing  
 Landing/TACAN

F-15

Attitude Director Indicator  
 A/A (Gun)  
 A/A (Missile)  
 A/G

F-111A

Manual  
 Command  
 Dive  
 Long Angle Drogue Delivery  
 Homing  
 Guns/Rockets

CL-84

Approach  
 Transition

AV-8A

Before AFC 105:  
 V/STOL  
 GEN  
 Navigation  
 REV  
 A/A

After AFC 105:  
 V/STOL  
 Navigation  
 Weapons a  
 Weapons b  
 A/A

MIL-D-81641(AS)

Takeoff/Navigation  
 Terrain Following  
 Bombing  
 Boresight Weapons  
 Guided Weapons  
 Landing  
 Boresight  
 Standby

MIL-STD-884B

Takeoff  
 Navigation  
 Terrain Following/Terrain Avoidance  
 Weapon Delivery  
 Landing

## LIST OF ABBREVIATIONS

A/A	Air-To-Air
A/C	Aircraft
ADI	Attitude Director Indicator
ADL	Armament Datum Line
AFC	Airframe Change
A/G	Air-To-Ground
AILA	Automatic Instrument Landing Approach
ALT	Altitude
AOA	Angle of Attack
APPR	Approach
ASE	Allowable Steering Error
AWL	All-Weather Landing
BARO	Barometric
CCIP	Continuously Computed Impact Point
CL	Centerline
COMP	Computer
DIV	Dive
FD	Flight Director
FOV	Field of View
FPM	Flight Path Marker
FRL	Fuselage Reference Line
HOR	Horizontal
IAS	Indicated Airspeed
ILS	Instrument Landing System
INS	Inertial Navigation System
IP	Initial Point

## LIST OF ABBREVIATIONS (continued)

KT	Knot
LADD	Long Angle Drogue Delivery
LDG	Landing
M	Mach
NAV	Navigation
NM	Nautical Mile
PCD	Precision Course Direction
RNG	Range
SEAM	Sidewinder Expanded Acquisition Mode
SPEC	Specification
SYM	Symbolic
TA	Terrain Avoidance
TAS	True Airspeed
TCN	TACAN
TF	Terrain Following
TGT	Target
THERMO	Thermometer
TO	Takeoff
TRAN	Transition
V/STOL	Vertical/Short Takeoff and Landing
VV	Velocity Vector
WPN(S)	Weapon(s)

REFERENCES

1. NATOPS Flight Manual A-7E Aircraft; NAVAIR 01-45AAE-1; changed 15 Aug 1971.
2. F-5 Technical Orders; T. O. 1F-5E-1.
3. Preliminary NATOPS Flight Manual F-14A; NAVAIR 01-F14AAA-1; 1 Nov 1973.
4. F-14A Programmable Display Generator HUD Symbology/Interface Requirements; Grumman Aerospace Corp Report No. A51-232-R-73-7; 22 Oct 1973.
5. F-15 (untitled)
6. F-15 Product Support Digest; Ready Room pp 8-12.
7. F-111A Technical Orders; T. O. 1F-111(V)A-1.
8. Gold, T. and Walchli, R. M.; Head-Up Display for All-Weather Approach and Landing of Tilt-Wing V/STOL Aircraft; AIAA Paper No. 74-952; 12 Aug 1974.
9. NATOPS Flight Manual AV-8A; NAVAIR 01-AV8A-1; changed 15 Feb 1974.
10. MIL-D-81641(AS); Display, Head-Up, General Specification for; 26 Jun 1972.
11. MIL-STD-884B; Military Standard Electronically or Optically Generated Displays for Aircraft Control and Combat; Cue Information; 4 Jan 1972.